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ABSTRACT

This manual, published by the Triangle Coalition for Science and Technology Education, is intended to serve as a resource for those wanting to bring the human and material resources of the scientific and engineering communities into beneficial and sustainable relationships with schools through volunteer programs that are locally designed and broad-based. While the focus here is on precollege science, mathematics, and technology education, the strategies and principles can be transferred to other subjects in the school curriculum. The manual emphasizes two critical levels of activity, within the individual schools and at the overall program level. Chapters include: (1) Collaboration-a new beginning, (2) Planning the program, (3) Formulating the program, and (4) Implementing the program. Thirty-four appendices include a volunteer program organization chart; responsibilities of coordinators and alliance; needs assessments for administrators, teachers, and community organizations; program sequence; precollege programs and volunteer opportunities; forms for volunteer applications, registration, sign-in, and recognition; volunteer brochures; tips for volunteers, teachers, and making presentations; typical science and technology topics; thinking and learning characteristics of young people; teacher request/volunteer job description; and evaluation by volunteers and teachers. (JRH)

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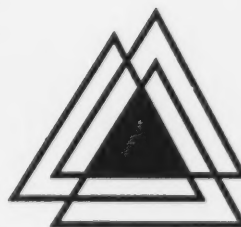
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**A guide for
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Triangle
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Technology
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The Triangle Coalition for Science and Technology Education, established in 1985, is directed by Dr. John M. Fowler and operates through a small staff located in College Park, Maryland. In 1990 the Triangle Coalition became a non-profit organization with an independent 501(c)3 status.

The Triangle Coalition is comprised of more than 100 national members with representation from business, industry and labor; scientific and engineering societies; education associations; and governmental agencies. Alliances, which are coalitions of interested institutions and groups working together to promote the improvement and reform of science, mathematics and technology education, have also joined as affiliate members. The Triangle Coalition works to link and capitalize on the unique resources of its national network of alliances and member organizations.

The Triangle Coalition has three unique features that distinguish it from all the other national organizations working for science education reform.

- It involves organizations from business, industry and labor as equal partners with those from science, engineering and education in efforts to reform science and technology education in kindergarten through twelfth grade.
- It provides direct linkages with a large number of broad-based alliances which are working at the state and local level to improve science and technology education.
- It has no vested interest in any one mechanism of reform.

The Triangle Coalition concentrates its efforts in three areas of action: communication, resource mobilization and advocacy. In each area it works to link and capitalize on the unique resources of the national networks of alliances and member organizations.

The core operation of the Triangle Coalition—staff and office, task force and steering committee meetings—is supported by scaled assessments on member organizations. Specific projects are supported by external grants and contributions.

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In 1988 the National Science Foundation, Division of Teacher Preparation and Enhancement, awarded a grant to the Triangle Coalition for Science and Technology Education for the pilot National School Volunteer Project in Science, Mathematics and Technology. The project's structure was designed to utilize the resources of the Coalition's national members while respecting the diversity and educational autonomy of the participating communities.

Established in 1985, the Coalition has as its mission:

- To bring together the ideas, influence and resources of a large number of national and local organizations to encourage and assist the reform of science and technology education for all students.
- To promote and assist the establishment of alliances, also called

broad-based partnerships, at the local level and link them with each other and with the network of national organizations to encourage and assist the reform of science and technology education for all students.

These mission statements guide the Coalition as we take on projects and suggest the mechanism through which we carry out projects. We search for projects that will benefit from the efficiency and organizational strength of a coalition and that can deliver the projects to the community level.

The pilot sites reflected a variety of geographic, ethnic, and demographic populations. We gratefully acknowledge the alliances, school districts, and communities that participated in the pilot project. Special thanks to the many volunteers and educators who gave of their talents to develop and refine the model materials presented in the manual. Among those deserving

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Colorado
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Introduction

This manual is intended to serve as a resource for those wanting to bring the human and material resources of the scientific and engineering communities into beneficial and sustainable relationships with schools through volunteer programs that are locally designed and broad-based. Individuals or groups should find it useful as they initiate programs to mobilize cadres of scientists, mathematicians, engineers and technical volunteers from business, industry, government and higher education to work with community volunteers, educators and students.

The program model we present draws from the experiences of the National School Volunteer Project in Science, Mathematics and Technology, which was initially piloted by five alliances in collaboration with the Triangle Coalition for Science and Technology

Education. As often happens, we benefitted from many who provided valuable guidance and resources as the project developed. Particularly helpful were other volunteer programs and the National Association for Partners in Education.

While we focus on precollege science, mathematics and technology education, the strategies and principles can be transferred to other subjects in the school curriculum. We strongly advocate a collaborative model that involves many community groups acting together. Such efforts have better chances of survival and result in synergy, the whole being greater than the sum of its parts.

The manual emphasizes two critical levels of activity, within the individual

schools and at the overall program level. The alliance* will broker a program that is designed around needs identified and plans developed by each participating school and that mobilizes community resources.

We invite you to create a new volunteer program or expand an existing one and believe the following materials will provide insights and practical guidance. Over time such efforts can have a significantly positive impact upon general science literacy as well as influence the numbers of individuals entering science and technology careers. Our experience has also demonstrated that such collaborative programs can result in formation of broad-based alliances and lasting cooperative relationships between educators and volunteers.

* *An alliance is a coalition of interested institutions and groups working together to promote the improvement and reform of science, mathematics and technology education.*

Developing and building a network

Coalitions are structured agreements between organizations which are created to achieve mutually decided goals and objectives. In this project, schools will collaborate with community organizations and an alliance. Successful coalitions are built on shared respect and trust and transcend narrow self-interest and personal goals. They are achieved with patient effort over time.

What is an alliance?

An alliance has a unique organizational structure which allows it to work in partnership with schools and provide them with strong collaborative links to universities and industries. Each alliance operates through its own structure and works closely with schools and school systems, but is not interwoven in the school structure.

Alliances are new social structures and their durability and stability require lasting commitment. General assumptions include:

- Effective partnerships are characterized by a high degree of collaborative planning, decision making and resource sharing.
- Collaboration differs from less complex relationships by the level of mutual involvement and commitment of the partners.

Collaboration—a new beginning

The alliance between business/industry and education is a natural one based on gearing up for survival: survival of students, business, public education and society.... Through creative partnerships with business/industry, schools can improve their programs and enhance their students' potential to meet their own and the nation's economic imperative.

(Regional Laboratory for Educational Improvement of the Northeast Islands. 1986. *Business-Education Partnerships: Strategies for School Improvement*. Andover, MA.)

An alliance is a broad-based community organization representing business and industry, institutions of higher education, professional organizations, government agencies and other stakeholders which work in concert with schools and school districts. The Triangle Coalition for Science and Technology Education, a national organization, is an umbrella or service group for alliances and has published a how-to manual on alliance formation, *A Guide for Building an Alliance for Science, Mathematics and Technology Education*.

Brokering—the value of an alliance

Brokering is the first step in bringing parties together and assisting them in negotiating

agreed arrangements. An alliance can work as a broker to form effective links between schools and the work place. This link requires active, enthusiastic participation of all the partners—schools, private sector, public sector, non-profit sector. Tension can be present and each partner needs to learn to accommodate general ways of operating on which all partners can agree. Partners bring differing viewpoints, language, habits, objectives and priorities to a project.

The broker acts as an intermediary, comfortable in several contexts and willing to forego personal credit in favor of instilling a sense of ownership of the project among the potential partnership leaders.

Benefits

There are practical reasons for encouraging collaboration. The following make a convincing rationale:

to local government and industry:

- Tax dollars are used more effectively to support school improvement.
- School system contact gives private sector employee volunteers broader vision and sensitivity
- Products, services and policies are better understood.
- Job training needs decline as the quality of the future employee pool grows.
- The image of the local community is enhanced.
- Educators and students make more informed public policy decisions.
- Equal employment opportunities increase.
- Employee morale improves as schools and local communities become involved in collaboration.
- Current volunteer efforts become better organized and more visible.

to the community:

- Ties are strengthened between community economic development and education.
- Public support for schools increases.
- Schools are better able to respond to business and community needs.
- Local taxes are used more efficiently.
- Community stability is enhanced; schools contribute to the vitality of the community.
- Cooperation among community leaders and organizations is enhanced.

to the schools and their students:

- Educators gain increased awareness of other points of view on many issues and a fresh perspective.
- Educators acquire access to new resources.
- Teacher and student morale improves.
- Business and management techniques help make school operations more efficient.
- Students and teachers become better informed consumers.
- Students and teachers are challenged by new ideas.
- Students gain an immediate connection to the world beyond school and an understanding of how basic skills are used in the real world.
- Students gain information about careers in science, business and engineering. Job skills are defined.
- Job opportunities for graduates may develop.
- Schools may receive additional equipment or materials.

Identifying the partners and forming the teams

This program model uses a team approach to develop comprehensive school-focused plans for bringing professional scientists, mathematicians and technology experts into the classrooms. The purpose of a team approach is to involve key decision makers in designing the plan. Early involvement greatly reduces potential problems during program implementation.

Building structure

There are at least two levels at which planning will occur. The alliance, with its broad representation, will serve as a broker to effectively link the diverse partners and provide the vision and persistence needed to sustain such an initiative. The alliance serves as a translator or an intermediary, easing tensions and moving comfortably within the different milieus.

Brokering

At one level, the alliance will work with an advisory or planning committee, which will have oversight for the development, implementation and evaluation of the overall program. At another level, the alliance will assist the school site partners as they reach consensus on the program priorities.

Using an organizational chart is one way to show program structure, i.e. relationships among the partners. It is important that the job descriptions are developed for each position and that each participant's role is clearly understood. Decision making should involve all participants so that information will flow across all levels, from the top down and from the bottom up. (See Appendix 1.)

II

Planning the program

A Guide to Working Partnerships reports that alliances which serve as brokers in forming partnerships are valuable because school administrators, teachers, business executives, line supervisors and agency workers tend to start in very different places. First, assumptions underlying the language each speaks will need clarification and brokering. Schools tend to talk process; business tends to talk products; agencies tend to talk regulations. Then, because of differing institutional priorities, objectives and habits, partners may arrive at decisions in different ways.

The alliance will continue to act as a broker after the sites have identified their team members.

Collaborations are complex relationships determined by a high level of mutual involvement of the partners. Successful collaboration must be built on a foundation of mutual respect and commitment to principles. All participants must respect each other as professionals. They must agree on a common set of principles before they begin to develop or initiate programs.

The following principles can guide a successful collaboration:

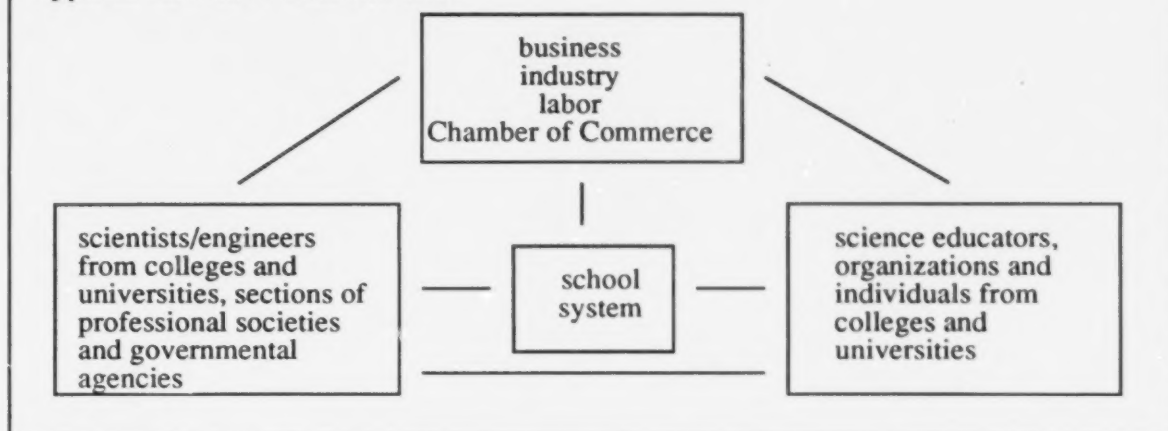
- Planning should include representatives from all sectors, with the alliance serving as broker for the collaboration and long-term planning. Partners should conceive of their efforts as part of that long-term plan.
- Commitment from business and industry leadership is essential.

The chief executive's support is absolutely necessary. The more directly he or she is involved, the greater the chance for success.

- On the school side, support from the individual school's principal is equally important. Of course, school superintendent and school board approval should be sought; but without the involvement of the principal, programs in schools simply do not work.
- All parties must accept the premise that the ultimate goal of the collaboration is to improve the education of all students. Nothing must interfere with that objective, even though individual projects may have more limited target audiences.

- Programs need not follow established patterns as long as they meet mutually agreed-upon goals.
- All parties should agree that the collaborative effort be given time to develop and should proceed slowly.
- Honesty and flexibility should characterize interchange between the partners. (i.e., schools should be realistic about what business can provide and open to new approaches. Companies should be straightforward about the extent of the resources they will commit and be sensitive to the realities of schools today.)

Typical alliance Interactions



Just as these principles should guide the collaboration, the following snares should be avoided:

Partners should:

- Realize that schools do not and cannot operate like businesses.
- Look at participation as something more than a means of recruiting potential employees.
- Stay away from publicity gimmicks.
- Promise only what can be delivered and be realistic about the results can be expected.
- Plan to make a contribution that is something more than financial.
- Build up to success.
- Stick with the program when it runs into the inevitable rough spots.

Cooperative efforts based on these mutually-held principles and on avoiding these pitfalls are successful. Before designing a program, the planning or advisory committee needs to examine the options available for each of the partner's involvement.

Setting goals and objectives

To be effective, the planning or project advisory committee must reach agreement on the central goal, that is, what is to be accomplished! Before the

committee can identify specific outcomes, target populations and programs, it must be clear what the goals of the school are, what needs exist and which specific objectives will lead to expected outcomes. This principle will be operative whatever the scope of the project (i.e. district or regional).

The committee members/decision makers need to be aware that:

- The alliance and a volunteer program can improve the quality of mathematics and science education.
- The strength of the program depends on commitment and involvement of all partners—school and volunteers recruited through the alliance.
- Resources for meeting school needs do exist in the community for meeting school needs. Conversely, the school has resources which may meet community needs.

The school team

Each school building will have its own plan, team and team leader. A liaison/coordinator should coordinate building or site projects and team leaders. Specific job descriptions for these positions are included in Appendix 2.

It is essential in planning the program that there is coordination between school and team leaders and those responsible for the overall program plan (the planning or advisory committee).

The school team's plan is designed to:

- reach a large number of people in a short period of time for the immediate dissemination of information
- gain an equally immediate response for action relating to member communications or organizing
- commit as many people as possible to helping with the program
- provide a most important service—personal contact with team members.

The structure of the building team is based on the following premises:

- Contrary to popular belief, people like to help, to be an insider, to be considered valuable and to be useful, but they generally need to be personally asked.

- The alliance can't and should not have to "do it all"—and ultimately will not.
 - The more people involved in the project, the broader the support base and hence the stronger the coalition.
 - The more person-to-person contact that takes place and the less mailbox stuffing done, the more closely knit and better informed the members will be.
- School teams might include:
- * administrator, superintendent and principal
 - * science teacher
 - * mathematics teacher
 - * community representative (at least one business volunteer)
 - * school board member
 - * site coordinator
 - * district coordinator
 - * alliance representative
 - * media representative
 - * special education representative
 - * scientist/mathematician
- Starred members are vital as team members. Each team will select a leader.
- The team approach to program planning increases the chance that the plan will be implemented once developed. The team approach, although burdensome at times, mandates collaboration between school administrators, teachers, community and alliance representa-
- tives. An alliance can facilitate the building of effective teams by identifying the decision makers within the school and the business community and sources of support in these areas. Who should be selected? Whose needs should be consulted?
- These teams will work with their leaders and the alliance coordinator in developing strategies for using scientific and technical professionals.
- In addition to previously listed benefits, other effects often emerge and blossom as one community volunteer contact leads to other potential volunteer and resources. Two examples are:

Characteristics of intervention programs that work

Over the past 10 to 20 years, special programs have been used to encourage children's interest and proficiency in academics and especially in science and engineering. Programs have worked in school and out of school, with students of all ages, cultures and races; with youngsters of exceptional mathematics and academic achievement and with high school dropouts; in fields from agriculture to engineering. Some programs use professional experts and the latest in testing and computer technologies; other work on shoestring budgets with egg cartons and volunteers. From these experiences, both successes and failures, have emerged lessons about what makes an intervention program work. The characteristics of successful intervention programs are listed below:

- Clearly defined educational goals
- high expectations among teachers and leaders
- committed leadership
- role models to motivate students
- peer support with a critical mass of students
- student commitment and investment (increased study time)
- hands-on laboratory experience
- assessment and feedback to students
- specific goals for minorities or women
- recruitment
- financial aid (fellowships and traineeships augmented by research assistantships)
- multi-year involvement with students and program evaluation based on student achievement.

U.S. Congress, Office of Technology Assessment, *Educating Scientists and Engineers: Grade School to Grad School*, OTA-SET-377 (Washington, DC: U.S. Government Printing Office, June 1988), p. 38.

Beaver County

In Beaver County, PA the local chapter of the American Society for Metals (ASM) became very interested in supporting the VIP Program. One member offered a field trip to his business, providing a demonstration of an electron microscope for science teachers. And the local chapter honored the volunteer coordinators of the two school districts involved in the pilot project at a special dinner meeting with the presentation of a book and a recognition certificate. This event was featured in a local news story.

It was more difficult to engage the personal involvement of the engineer members in the classroom. One engineer was especially interested in taking an active part. However, he preferred to come into the classroom in a structured situation.

To that end he began to work with the national ASM office to develop demonstration kits which engineers could use in the classrooms. Singly he obtained an NSF grant to produce ten kits demonstrating the new developments in materials science and accompanying guidelines for the teacher for grades five, eight and eleven. Consulting with the Pittsburgh Regional Center for Science Teachers (PRCST), these kits were then field tested in local schools.

Currently the kits and accompanying materials are being refined for a second round of field testing. The goal is to work together with the ASM in providing these demonstrations for use by engineers in active ASM chapters throughout the United States. The engineer, Richard Krepski, and Jane Konrad, executive director of PRCST are working on a Focus Group of the ASM Educational Committee addressing appropriate materials and volunteer training which can be brought into science/math classrooms by ASM engineers.

South Florida

The Florida Alliance for Technological Education and the Triangle Coalition's NSVP Project are providing elementary students a chance to learn about horticulture. The South Florida Alliance Horticulture Program uses the resources of the alliance, the Triangle Coalition, 4-H, the U.S. Customs Department, the Dade County Agriculture School and local nurseries and other businesses to provide a one-day tour and workshop on horticultural and agricultural practices.

The Dade County Public Schools' Agriculture school is the site for the program and provides transportation for the fourth-grade students to attend and tour the school's facilities. After the tour, students attend a workshop, which gives a student-level overview of horticulture based on the county's science curriculum. The students are then allowed to visit with various farm animals and understand the relationship between horticulture and agriculture. Volunteers from the NSVP Project, as well as student teachers and high school students assist the students through the tour and coordinate the workshop.

The students return to their classroom with a terrarium built by the junior high students of the agriculture school. Not only does this program provide a hands-on experience for the elementary students at the ten sites, it also involves the junior high students of the agriculture school who are generally considered to be "at risk." The elementary students are also given seeds and small plants to start a garden at their school. The students are encouraged to sell these plants at the end of the school year and then to use the money to purchase seeds and plants for the program for the following year.

Characteristics of a successful program

For the potential impact of volunteer scientists and engineers to be realized on a wide-scale basis over the long term, a sustained program that uses a systematic, consistent approach nationwide must be implemented. Goals and objectives could be:

1. Facilitate the establishment of long-lasting cooperative arrangements between teachers, schools and the volunteer resources.
 - Broker broad-based volunteer programs within the communities.
 - Produce resource materials and publicity strategies for the program.
 - Maintain a cadre of experienced local volunteers.
 - Provide appropriate orientation training and support materials for the educators and volunteers.
 - Suggest mechanisms that promote curricular integration of the enriching activities within the instructional programs.
 - Provide evaluation instruments to document the program and the effective use and impact of volunteer resources.
 - Create opportunities for participants to network among themselves about program experiences, revisions and plans.
2. Identify, recruit and match science, technology and mathematics resources with specific and identified instructional needs in the schools.
 - Provide contact information for potential volunteers.

- Produce and disseminate brochures and other materials through associations.
- Maintain a database of site and contact information on science, mathematics and technology volunteers and other resources.
- Facilitate the planning for volunteer recruitment through consultation and program materials.

No academic or volunteer program can face alone the formidable task of confronting a culture in dire need of scientists and engineers.

The future supply of scientists and engineers depends on how well schools, families and communities encourage children to study science and engineering. It is not easy, though, to identify what factors encourage students to prepare for science and engineering careers, or what factors deter them. Students need interest, ability and preparation in science and mathematics; none of these is sufficient alone. In general, family, friends and the media shape students' attitudes about careers in science and engineering.

The national pool of professional talent needs to be large and versatile, maintaining a vigorous science and engineering work force as well as technologically literate citizens.

- Capable young people must be welcomed throughout the educational process.
- Talent must be nurtured by elementary and secondary schools.
- Students must perceive employment opportunities that utilize their talents and provide fulfilling work.

And the pool of potential talent needs to go beyond developing a supply of scientists and engineers. To prema-

turely shunt aside students or accept society's gender, race and class biases in its talent selection means the educational system is out of touch with reality. A viable volunteer program can convey information about desirable social and intellectual characteristics of scientists and engineers while also conveying information about related careers.

The loss of potential scientists or engineers to another profession is still society's gain. We would hope that our education system would prepare students for careers that will be in demand. But the market is too unpredictable to target specific personnel needs, so the goal of education, including science and engineering, should be to prepare students for an uncertain future by imparting a range of skills.

The alliance will act as the liaison to bring together participants identified as potential partners in building a collaborative volunteer effort.

Establishing the advisory committee

Most schools and school districts are interested in developing or expanding school-community collaboration. By beginning slowly and carefully seeking each participant's input into the major decisions a stronger collaborative can be established.

Once the community interests have been determined, the alliance will explore the desire of each business/organization to participate in a partnership. The next step is to formally approach the highest levels of the school system and the community leaders.

School system

The local superintendent's support is necessary, although he or she may not be directly involved in each school's program. In many areas, an assistant superintendent for curriculum and instruction will be the district-level administrator involved in the program.

Since school boards are responsible for setting school policies and goals, they need to be informed about proposed collaborations. Board support will strengthen the alliance's relationship with the schools and board members' links to the community will help promote the programs.

The school building principal is likely to be the administrator with whom the alliance will work most closely as the program develops. But do not overlook the necessity of soliciting and maintaining support from the upper levels of the school administration. This support is as critical to the program's success as that of business chief executive officers (CEOs) or community organization chairs.

III

Formulating the program

The school staff

The alliance will work primarily with the school district coordinators, but also works with the principal, school team coordinator and teachers.

The principal is as important to the success of the collaboration as the business chief executive officer or organization chair. He or she must be willing to support its operations with the resources that the principal's office commands. The principal works with the school team coordinator and keeps in touch with the day-to-day program activities. The principal can also be a spokesperson for the project to other schools and companies.

The school team coordinator is the counterpart of the business coordinator. He or she needs the same kind of enthusiastic commitment to the program and its principles. The school team coordinator is the link between the school system coordinator, teachers and business volunteers. The school team coordinator's responsibilities are similar to those of the business coordinator.

The teachers' support and commitment are essential to the success of any program involving students. Include teachers in program planning sessions and seek their advice on content, materials and teaching strategies to enlist their support and benefit from their experience. Programs that are not supported by the classroom teachers will not succeed.

The community participants

Collaboration with businesses and organizations may involve three levels of support: the chief executive officer, the corporate officer in charge of the initiative and/or the coordinator of company/school activities. Each has responsibilities and each is vital to the success of the project. Of course, specific responsibilities will depend on the nature of the activities undertaken. Bear in mind also that in many companies the responsibilities of the corporate officer in charge and those of the coordinator may be assigned to one individual.

CEO or chair

The role of the CEO or organization chair will be the same no matter what the size of the program or the number of employees involved. Responsibilities will be to:

- Determine the company/organization's general level of commitment.
- Authorize use of resources.
- Assign an officer to monitor program development.
- Enthusiastically promote participation.
- Support means of rewarding employee/member participation.
- Attend initial meeting of advisory committee with school system and alliance representatives (or designate a responsible officer to do so).
- Thank school and company/organization participants, in writing, if possible, at the beginning of collaboration and as individual programs are completed.
- Publicize company/organization participation.

Once the program is underway, encourage these CEOs/chairs to stay in touch with the program, participate in activities, acknowledge employees who take part and recruit additional middle and upper level professionals to take part and reaffirm the company's commitment at regular intervals.

The officer in charge

In general, however, the officer in charge will come from one of three areas within the business/organization: human resources, corporate contributions or the department of corporate social responsibility, public involvement or public affairs.

The corporate officer's responsibilities will overlap with those of the CEO and coordinator. Responsibilities include:

- Specify the company's level of commitment—how many departments, how many hours, how many people, how many schools?
- Survey current company involvement.
- Design the master plan for company activities.
- Develop a budget.
- Promote the program and encourage additional participation.
- Inform CEO of progress.
- Supervise the development of the master plan.
- Select or serve as the coordinator of company/school volunteer activities.
- Establish a plan for publicizing activities within the company and to interested parties outside the company (other companies, the press, educators, parents, community groups).

- Make the continuing personal commitment of time and energy to ensure success of the program.
- Participate in program activities as needed.

The project coordinator

Is there anything left for the coordinator to do? Indeed. He or she will stay busy arranging and overseeing the day-to-day operations of the program. Specifically, the coordinator can expect to perform the following tasks:

- Draw up a detailed plan of action.
- Recruit volunteers.
- Assign responsibilities.
- Allocate resources.
- Work with the school coordinator (his or her opposite number).
- Become familiar with the collaborating school.
- Coordinate the company side of scheduling, placement, time, changes and evaluation.
- Promote the program.
- Stay on top of day-to-day activities.
- Arrange for follow-up: thank participants, distribute copies of any program publicity.

The initial meeting of the advisory committee fulfills two purposes: it brings together the major participants and those on their staffs who will develop and coordinate the program; and it lays the foundation for program development. Personnel at this meeting may or may not include business CEOs, organization chairs, the school system superintendent, the school board president and school principals; their representatives can act for them.

If collaboration is not to be limited to a specific project but will involve many kinds of support, than the business/industry and organization/university should survey available resources. The school should conduct a needs assessment. These exercises will focus future discussions and give them a basis in reality without raising false expectations.

You can assure the success of this meeting by handling it like any other kick-off session. Pleasant surroundings, a definite agenda and an atmosphere of interest and commitment will go a long way toward getting the project off the ground. The key element is that the people you are meeting and with whom you will be working are professionals. Their capabilities and skills in their profession are equal to yours. Similarly, their desire to begin a fruitful collaboration matches yours.

Most likely, the first meeting will be devoted to the formal aspects of initiating the collaboration—introducing participants, describing the businesses/organizations and the school or schools involved, perhaps touring the site where the meeting is taking place (company or school) and then having an audiovisual presentation or other informational introduction. Participants should reaffirm at least their general commitment to the principles of collaboration and present the general outlines of what they expect to achieve.

At this time or at a second working session, the participants will have to agree on a strategy for planning, funding and implementing their program. Decision makers will probably include the corporate officer in charge and the volunteer coordinator, if these functions are separate, organization chairs, the superintendent (perhaps the assistant superintendent for curriculum and instruction), the principal and a school system coordinator. Often school districts will already have someone on staff who coordinates programs between the

school and outside agencies. His or her experience will be valuable.

At either the first formal meeting or the second working session, participants must reach a decision on the kind of programs to be developed.

School responsibilities

As the focal point of partnership activities, the school has varied responsibilities. The school should:

- Provide staff assistance to coordinate and support on-going partnership activities.
 - Develop training materials and programs and to publicize the program and provide participant recognition.
 - Reproduce and distribute of training and orientation materials and newsletters or other forms of communication within the school system, with business partners, parents and the community at large.
- Give teachers release time to attend training and orientation sessions, off-campus visits, local travel and substitute teachers to take regular teachers' classroom duties during these times.
- Have a teacher or school coordinator supervise the volunteers' activities.
 - Cover Incidental expenditures for supplies and recognition events such as lunches and dinners.
 - Arrange transportation for student field trips and other off-campus partnership activities where school buses are used.

The major need is likely to be the school system's partnership coordinator. Communities with extensive partnership efforts involving the entire school system often establish a partnership office, perhaps with

several staff members who work only on partnership-related activities. Less extensive efforts might be handled by one full- or part-time school system coordinator. A partnership program involving a few classes in a single school might be able to function adequately with a few hours of time each week from a teacher, guidance counselor or administrator.

Community responsibilities

The major resource that businesses/organizations give partnerships is the volunteer time of their employees. Most businesses expect their employees to maintain their regular workload and responsibilities while serving as volunteers, but allow them flexibility in working hours to facilitate participation in the partnership. Thus, there is little or no direct cost to the business.

However, some businesses have been enthusiastic about partnerships and have committed resources in a variety of ways. For example, firms may subsidize employee participation by allowing volunteers to bill time to community relations or another overhead account. Businesses may also subsidize school teachers to develop materials needed for the partnership.

Business volunteers are the new "ingredient" that makes the partnership approach to improving science and mathematics different from other approaches.

The advisory committee in the collaboration stage assumes a life of its own in many ways. The partnership team now operates with its own group dynamics. The bond that develops among individuals who work well together over time helps create a semi-autonomous working unit, which functions across organizational boundaries. The advisory committee shares its own vision, sense of purpose, motivation, policies and procedures.

At this stage, the advisory committee team takes most of the responsibility for planning and decision making. It is an established entity, with a legitimate mission and a solid structure. Members and activities may change, but the partnership infrastructure remains. The community partners view it as a successful mechanism for supporting and contributing to education.

Additionally, participants will conceive of ways for the school-based members of the team to contribute more tangibly to the needs of the community partners. Teachers may be employed during the summer as curriculum developers or basic skills instructors. Students may become involved in internships or apprenticeships. The school band may travel to the community facility and perform afternoon concerts. The physical education staff may develop an aerobics program for business employees. The need to reciprocate gets stronger the longer partners work together.

Besides establishing objectives that address the desire to reciprocate in concrete ways, the advisory committee usually sets a goal of broadening the partnership activities. Expanding to include more schools, districts or even social service organizations and colleges within the existing infrastructure is one way for a partnership to continue its evolution and a signal that it has reached the hallmark of collaboration and mutuality.

Even this brief description of an advisory committee and how it works indicates its strengths and weaknesses. The primary strength, of course, is the collective caliber and clout of the individuals who serve on them and of the institutions they represent. Participation in the work of the advisory committee is for blue-ribbon panel members and results are blue-ribbon results. This approach is effective for energizing all community resources and implementing strategies that disregard traditional boundaries between business, education and labor.

Advisory committee membership is drawn from the highest level of the participating institutions and committee activities benefit from this access to the local power structure.

Conducting assessments of needs of all constituencies, that is school and community partners, will provide critical information for designing local volunteer programs. Sample assessments are in Appendix 3. Such efforts, early in the planning, do much to ensure broad support for the program, since all of the partners will feel a sense of ownership.

With this accomplished, it is time for the first meeting of the school team. The brokering role of the alliance will continue throughout the program works specifically to ensure the success of the first school team meeting. A sample agenda can be found below with meeting tips.

Agenda for the first school team meeting

- Introduce members.
- Review role responsibilities briefly with a flow chart.
- Review issues confronting the school.
- Tie national goals to local needs/goals/objectives.
- Address assessment of school needs.
- Discuss current use of resources/programs.
- Review program models appropriate to school needs.
- Arrange for a final acknowledgment of consensus—this may take the form of school board approval.

Successful meeting tips:

- Arrange convenient time/site
- Provide refreshments if appropriate
- Plan active participant involvement
- Vary presentation modes by using: audio-visual presentations; films, slides, transparencies and videotapes; guest speakers if appropriate; alliance representa-

tives; advocates for the program(s); experienced and enthusiastic school volunteers; business and industry representatives; panel discussions; and brainstorming sessions.

- Arrange the next meeting before leaving.

Many of the decisions on how the program will work, particularly at the school level, must be made by the school team. Thus, these school team meetings are critical to the success of the program. Issues such as signing-in volunteers, creating daily schedules and meshing the program with existing efforts can be addressed in these sessions. (See Appendix 4.)

Communicating information to the volunteers will be a responsibility shared by the alliance and the school.

Each team plan will reflect the philosophy of the school faculty and the goals of its instructional program. This individualized prescription will be invaluable as the alliance seeks to recruit and supply volunteers to match the requests that come from the school.

We suggest that each school have a coordinator for organizational purposes. This person will be the point of contact for the program, with the alliance and the school district. This team coordinator will:

- Keep a close working relationship with the alliance.
- Be available for receiving information.
- Disseminate information within the school.
- Motivate colleagues to participate in the program.
- Communicate the school's sentiments and concerns to the alliance and district.
- Enlist the assistance of others to maintain the program within the school.
- Solicit and transmit input from colleagues on program policy and practice.

The alliance and school coordinators may find the following useful in forming teams at the building level; generally people need to be asked personally to be part of the team.

- A. The coordinators cannot and should not have to do all of the planning and work for the program.
- B. The more people involved in the program the broader the base of support will be for the program, and the stronger the program will be. The more person-to-person contact that takes place and the less mailbox stuffing, the more close-knit the group and more inclined people will be to participate.

The building team may also find the following exercise helpful in planning school participation in the program.

First: divide the building into units such as grade levels, wings, or departments.

Second: list the faculty who by practice or propensity, would be additional team members. This will make the team's task easier and more effective. Analyze who the influential people in the school are and ask them to become part of the team, even in a small way.

Third: assign a team member to each unit, preferably to a unit with which he or she has daily contact.

Fourth: list faculty who may be less inclined to participate in the program and make sure that each is contacted.

Traps for the building team to avoid:

- failure to involve those who have never been involved in other such programs

- using only written correspondence
- failure to follow-up on requests or comments
- creating nonessential forms or procedures
- requesting form return during busy school schedule times
- failure to act on faculty suggestions
- requesting faculty to attend meaningless or too many meetings about the program (see planning the ten minute building meeting below)

Planning the ten-minute meeting

Minutes

2 minutes: (minutes 1-2)

Topic/Rationale

Brief overview of major topics, either new or previously discussed. *We're keeping team members informed. We try to reduce the hush-hush attitude so often prevalent during negotiations. Keeping members informed is not a matter of how much they are told. Rather, it's a matter of their feeling that leaders are working hard and regularly to inform them.*

4 minutes: (minutes 3-6)

Here is a current issue. We need your consensus before we go to the next planning meeting, where we shall submit your collective views.

The mere process of getting consensus reinforces in each participant's mind that his/her opinion is actively sought and subsequently presented to the planning committee. The coordinator who neglects this step is asking for mistrust and hostility from members.

3 minutes: (minutes 7-9)

A three-minute review of a current issue that is close to the heart, soul and guts of team members in this building.

This may not be the burning issue to come up at the planning committee but team members need to feel that the program takes note of a currently felt need of theirs. We could fill up these minutes with "important matters," but the individual team member needs to feel some relief on a topic that touches him/her. Often just talking about a problem gives considerable relief.

1 minute: (minute 10)

We're having some success in this area or we're optimistic in this area, thanks to your efforts. Keep up the good work.

Praise. Encourage. Nourish the team members toward developing a spirit of cautious optimism. An "all is lost" attitude, culminates in "I give up," and too often kills support for the program's goals, especially during negotiations.

"Time's up! We told you we could do it in ten minutes! Don't forget to leave your questions and suggestions at the door."

Alliances are structured to mobilize a cadre of scientists, mathematicians, engineers and technical volunteers. Therefore, the alliance will have the major responsibility for finding volunteers which appropriately match the school requests as received from the school leader (site or district coordinator).

Identifying and recruiting volunteers to fill these requests will expand and strengthen the education/community partnership.

Collaboration has become a key term in addressing solutions, a realistic way to move ahead effectively in our increasingly technological society. In trying to meet the educational mandates coming from the federal, state and local levels, grassroots initiatives can provide leadership, sustained collaborative mechanisms, legitimacy and ownership. The alliance offers information and planning activities, continuing resource support and effective processes for developing the school/community partnership.

Where to find volunteers

An alliance may already have a listing or database of community resources. Since the alliance will have the major responsibility for finding the requested volunteers, it will be your first and most important resource for volunteer recruitment. (See Appendix 5.)

Look first within the school community. Team members can supplement or expand this list through parent, school or their own contacts who may volunteer or suggest other potential volunteers. In pursuing these contacts, explore, too, volunteer hobbies or avocations. Many times there are individuals with great expertise in areas outside their employment area. Check the local hobby shops. Senior citizen groups often gather at school sites for lunches and programs. They

IV Implementing the program

There are no rules for successful collaborations. There is no one right way to proceed, nor is there a single formula for success. There are many successful programs—all different and all flourishing—and they share certain characteristics even if their structure, program, goals and activities vary widely.

American Council of Life Insurance, 1987, *Company-School Collaboration: A Manual for Developing Successful Projects*. Washington, DC.

are a willing audience and may become individual volunteers or help to identify other potential volunteers.

Working with faculty to identify students with expertise in science, mathematics and technical areas. School clubs also offer potential help.

Consult the telephone Yellow Pages! Technical expertise can be found in any community whether large or small. You should be able to find one or more of the following: telephone repair/service facility, electric utility service facility, medical clinic/laboratory, veterinary clinic, pharmacy, automobile repair shop, agribusiness or other facility. Contact the local pet shop to locate people with expertise with animals. Amateur radio operators have experience which could spur a student into a whole new career path.

Local and national organizations/programs offer a ready-made selection of resources which can be incorporated

into the volunteer program—or customized to fit the request. Corporations and institutions of higher education often provide employees release time for volunteer work and even encourage their employees/members to become active participants at the precollege level. College students may be interested and

available for involvement either through their course work or individual interest. Education students may welcome a chance to be in science and mathematics classrooms.

Many business and professional groups may have retired members/employees willing to share their experience and expertise. Contact the local and state chambers of commerce for listings of community business. Explore organizations like Generations Together and programs like those run by the Area Association for Aging.

The Triangle Coalition for Science and Technology Education represents over 100 national organizations from business, industry and labor; science and engineering; and education in its work with alliances. All of the Triangle Coalition's members share the goal of improving science and technology education for all students.

Identifying resources

By and large, school systems and business personnel are unfamiliar with each other and have different perspectives. Thus, the process of working with each other is of major concern. In addition, both schools and businesses are relatively new to the partnership game. Therefore, all sorts of things can go wrong. Partners should address eight key issues to minimize volunteer-related partnership problems. These are:

- recruitment
- matching volunteers with students and/or teachers

- orientation and training
- planning the volunteer activities
- reliability
- helping volunteers perform well
- feedback for volunteers
- recognition/incentives for volunteers

Each of these issues is discussed below.

Recruiting volunteers

The alliance will have the major responsibility for finding appropriate volunteers to fill school requests received from the school leader (either site or district coordinator). Alliances are structured to mobilize a cadre of scientists, mathematicians, engineers and technical volunteers. (See Appendices 6 through 10.)

Volunteers can:

- provide classroom demonstrations and lectures in support of regular classroom teaching.
- teach regular classes for one or more classes.
- provide voluntary enrichment experiences for students outside of regular classes, such as in resource laboratories or advanced weekend or summer classes (generally non-credit) taught by, or involving participation of, business volunteers.
- tutor students. Volunteers provide remedial assistance related to regular coursework to one or a small group of students.
- provide mentorship experiences. These may take place in the school, in which case volunteers work with students to guide them on special projects, such as

science fair entries, or the mentorships may take place outside the school. In the latter case, students are exposed to career-related experiences at the volunteers' work place. The students' work may or may not involve project work or class credit.

- * Review Triangle Coalition and other publications which may list potential volunteer sources. The Triangle Coalition will work with the alliance to recruit volunteers through its national members. The Triangle Coalition brings over 100 national organizations from business, industry and labor; science and engineering; and education together for the purpose of improving science and technical education for all students.

Tips for recruiting

1. Start small and recruit to closely match the school requests. Volunteers who commit and are not actively used become discouraged.
2. Recruit year-round and maintain a file of active volunteers. Major efforts may be needed at the beginning of each school year.
3. Clearly describe the program elements and structure so that volunteers understand where they will fit, their contribution and the rewards and benefits involved.
4. Prepare and disseminate printed materials. Place announcements in newsletters or post on bulletin boards. Mail announcements to prospective volunteers.
5. Hold special recruitment meetings with help from volunteers and students involved in current partnerships.
6. Use personal contacts, especially those of past and current volunteers, to recruit others.

7. Use computer searches of employee lists to target potential volunteers. This may be particularly useful in obtaining minority volunteers.
8. Provide video presentations to prospective volunteers.
9. Maintain a list of persons that have inquired about or expressed interest in the program.
10. Encourage past volunteers to continue. Past volunteers whose work was good quality will be even more productive the second time around and they are also a major source of future volunteers.
11. Go through business organizations and professional societies, perhaps by inserting announcements in their newsletters.

Not everyone is appropriate as a volunteer. Those sought should:

- Be knowledgeable in the subject matter.
- Possess good people skills.
- Be enthusiastic and interested in working with students and teachers.
- Be reliable.
- Have past experience in teaching or working with youth.
- Be a good role model.

Knowledge in subject matter. Recruiting should be targeted toward employees who can provide the skills and/or experience that partnership objectives require. For many partnership activities, the volunteers should be people who actually apply the math or science skills in their work.

Good people skills. Good people skills and the ability to establish rapport with students and teachers are very important. People with highly advanced training sometimes have difficulty interacting with students at a level that students can understand.

Enthusiasm/interest. Partnerships require commitments of time and energy on the part of volunteers. Volunteers with a genuine personal interest in and enthusiasm for, working with students and teachers are most likely to sustain this commitment. These traits are also helpful in establishing rapport with students and in generating their enthusiasm for the subject matter. Volunteers who are unilaterally assigned to the partnership by management are less likely to be as enthusiastic or interested as true volunteers.

Reliability. Volunteers have to be reliable and dependable. Individuals with substantial and unpredictable travel or meeting schedules are not good candidates. Business professionals near the schools in which they are to work are likely to find it easier to meet the school schedule.

Past experience in teaching or working with youth. People with teaching backgrounds (for example, as teaching assistants in college) are likely to find the adjustment to working with students and/or teachers easier and become effective more quickly. There are likely to be a few such people in many businesses. Persons with experience in youth-oriented activities (for example, Big Brothers or Big Sisters, Scouts and other organizations) will usually know how to work with

young people. Although prior volunteer or teaching experience is desirable, this should not be required.

Good role model. Volunteers are likely to be looked up to and emulated by students. People should be sought whose lifestyles are respected by managers and co-workers. For working with racial/ethnic minority students, or with a particular gender, volunteers with similar characteristics are generally preferable.

Matching volunteers

One way to promote successful partnership activities is to make good matches between volunteers and students or teachers. One aspect of this process is to ensure that the volunteer has the appropriate background or skills to teach the desired subject matter. Another is to develop a comfortable fit in terms of personalities, interests and the ability to communicate and establish rapport. This is particularly important in partnership activities where there is one-on-one involvement between the volunteer and the student, such as mentorships and tutoring arrangements. A good fit is also particularly important for attempting to help minority students—by providing a role model. Female, black and Hispanic scientists and engineers are likely to be especially difficult to find because of their relative scarcity among professionals in some mathematics and science occupations, however, this should be attempted.

To make good matches, the school coordinator should obtain information about volunteers and students (and teachers, in those cases where volunteers work in the classroom with the teacher) before deciding on matches.

Volunteer orientation

Whenever possible, the alliance should conduct an orientation for the group of volunteers who will participate in the

project. Include the school teams in the orientation. One model is to open with a general program orientation followed by specific school site orientation. This can be combined with a luncheon, coffee or other event. If business or other volunteers find it impossible to attend a group orientation, plan for a brief welcome/orientation on site at the first visit. Plan to allow time for this when scheduling the volunteer assignment. (See Appendices 11 and 12.)

Orientation helps volunteers become familiar with the project and the elements of its design. Volunteers committing to the project will need orientation on two levels:

Orientation to the project as a whole : Describe the role of the alliance. Brief volunteers on the project: its history, its purpose and its scope nationally. Talk about the school's goals and needs locally. Tell the volunteer where they fit within the project structure. Introduce the school coordinator and school-based team.

Orientation to the school site : Give the volunteers practical information of the school's location, access, parking and floor plan. Review basic information on check-in, emergency rules, health test requirements and illness, fire drills and exits. Tell them where the phone, restrooms, coffee machine and coat-rack are.

Familiarize volunteers with the administrative aspects of their participation, such as schedules, parking, security and any student evaluations/grading they are to do. Explain time/activity logs and evaluation forms.

Give volunteers an orientation to the curriculum and the teacher's approach. In addition, many volunteers do not have experience with children of the same age as those in the partnership, or are not familiar with the abilities, behaviors and attitudes children exhibit at different ages. They may also be inclined to expect too much from the students and talk over their

heads. They may need to be familiarized with basic teaching techniques such as using chalkboards or handouts to emphasize key points or asking questions to get students involved.

Volunteer-teacher relationships

The volunteer project is teacher-directed; volunteers need to be told what is needed and what is expected of them. Teachers should communicate:

1. how they intend to include the volunteer in the curriculum and exactly what they are requesting.
2. the style preferred: values, ethical issues
3. what level the students currently are
4. at what level the volunteer is expected to perform—superficial, in-depth, concept formation or current content update.
5. something about the learning process
6. characteristics of the development stage of the class
7. special class or student needs

This information is in addition to that on the request form.

Teachers should review school policy and philosophy with the volunteers so that they understand how important it is that they are reliable, on-time and notify school of any schedule change; and maintain confidentiality about the school, classroom and students.

A sheet of tips can be reproduced for the volunteers. (See Appendices 12-1 through 12-5.)

Review the benefits and rewards of volunteering and bringing expertise to the project. Provide recognition and appreciation for volunteer participation.

Model Agenda

- Welcome
- General review of the project goals/needs requests—types and amounts volunteer recruitment-sources, types, availability volunteer orientation
- Discuss logistics of utilizing a human resource. problems rewards sensitive areas (such as ethics) physical arrangements
- Develop appropriate volunteer job descriptions.
- Develop appropriate volunteer evaluation.
- Develop appropriate volunteer recognition.
- Assign materials and program development if this is not accomplished during the meeting. Arrange for sequential meetings to continue training, idea exchange; allow for a shift of focus, problem solving, materials development and team relationship development.

Faculty orientation

While the volunteer project is teacher-directed, alliances must work with the faculty, including school-based teams and administrators to develop:

1. an understanding of the volunteer's role
2. a plan for making the volunteer a part of the team
3. the teacher's comfort level in bringing a volunteer into the classroom.
Address:
 - a) fear of volunteer as a competitor
 - b) uncertainty about what the volunteer will do or say—accuracy, conceptual level, values and ethics
 - c) worry about the volunteer maintaining confidentiality
4. responsiveness to the volunteer's physical and emotional needs
5. physical arrangements for the volunteer: parking, check-in, welcome/orientation, coat rack, restrooms, coffee (physical amenities), materi-

als, lesson plans for tutors

6. volunteer requests which relate to school goals/needs and are specific concerning what is needed and expected of the volunteer. See Appendices 14 and 15.
7. a plan for evaluating volunteer performance and student impact where possible.

An enthusiastic, dedicated project coordinator is a key player in this training and in continuing support of the faculty. Administration should reinforce the school's commitment to supporting the coordinator financially, with release

time and with cooperation in arranging planning, orientation and volunteer recognition times and materials.

Faculty training can begin with a luncheon, coffee or other pleasant event. Provide comfortable surroundings.

Assigning volunteers

Volunteers, like paid employees, function best when they are in a job they enjoy, working toward their potential and developing new skills. While volunteers are not paid, there are still requirements for participation. Volunteers perform more consistently and productively when:

- opportunities are specifically described
- time required is indicated
- they understand the reason a particular task is required
- work can be done at a convenient time and place
- the task requires a skill they are motivated to use
- they are made to feel important

- they can see the results of their work
- they receive guidance and direction in the early stages
- they are asked to share ideas and give feedback about their assignment
- they feel a camaraderie with others involved in the organization.

A partnership is a team activity and needs a great deal of communication to help get everyone together at the right time, in the right place and with the needed information to carry on the activities properly. Poor communication has plagued many partnerships, at least temporarily. Communication can be difficult: volunteers spend most of their time at other facilities; teachers have tight schedules and usually are difficult to reach by telephone; students are not always dependable.

Helping volunteers perform well

Here are some additional suggestions for improving volunteers' ability to help students:

1. Provide substantial assignments to volunteers. Avoid using volunteers as substitute teachers or as teacher aids with few important responsibilities.
2. Encourage a teacher or past volunteer to act as a buddy to help each volunteer, especially new ones, adjust to the school environment and become an effective teacher.
3. Encourage volunteers involved with teacher-like duties to meet and converse with other teachers. Likewise, encourage other teachers to meet and converse with the volunteers and make them feel at home.
4. Do not discourage volunteers from using unusual teaching

The meaning of life here on earth might be defined as consisting of this: To unfold yourself, to work with thing you have the faculty for. It is a necessity for the human being, the first law of our existence.

Thomas Carlyle

approaches and tasks, such as games, simulations, field trips, guest lectures and demonstrations. Make sure such devices are carefully planned by the volunteer to serve a learning function.

5. Provide the volunteer with timely and regular feedback from other students and teachers.
6. Hold sessions once or twice a semester for volunteers to meet each other and share material, problems and solutions. These can be sponsored by the business if the business provides multiple volunteers. If the partnership draws one or two volunteers from each of many businesses, the school coordinator should arrange these meetings.
7. Recruit enough volunteers to keep workloads at reasonable levels to avoid volunteer burnout.

Feedback for volunteers

Below are suggestions for feedback mechanisms:

1. Have the school coordinator and the teacher sit in during the session(s) presented by the volunteer, or at least during part of those sessions. They can then provide constructive suggestions to the volunteer.

2. Encourage the teacher and coordinator to obtain informal feedback from participating students (or the participating teachers, for teacher-focused partnerships).
3. Keep records of the attendance and punctuality of each volunteer. When a problem arises the school coordinator should discuss the problem with the volunteer.
4. If possible, record or videotape part or all of one or more sessions. Have the teacher or school coordinator identify constructive suggestions for improvement and provide these suggestions to the volunteer.
5. Encourage teachers to provide informal feedback to the volunteers before or after sessions. Encourage volunteers to chat with teachers before or after their presentations.

Volunteer recognition and retention

A viable volunteer program of any kind is based on a sound structure of training/orientation for the task at hand followed by appropriate and sufficient recognition and praise.

A volunteer's reward is the satisfaction of a job well done—of making a significant contribution and a thank you for their involvement.

Reasons for volunteering can differ greatly and recognition must take into account those various causes or reasons for the volunteer involvement. By definition a volunteer enters into the program as an individual, freely offering services, with no expectation of monetary compensation. In America volunteerism is an accepted way of life, perhaps based on our Puritan work ethic foundation. Certainly Americans respond very differently to the volunteer call than citizens of other countries throughout the world.

In addition to individual motivations, however, there may be other influential factors related to the volunteer's work situation or association membership, public relations involved and/or community status. These variables need to be taken into account as volunteer recognition is planned.

While the reasons for volunteering are complex and difficult to classify accurately, it is motivation which excites the individual to respond: an idea, need or emotion. This may be conscious (such as a response to an invitation, request for help) or unconscious (an impulse to bolster ego or increase security). Let's examine a few of these:

- **Power drive:** Some people want to satisfy a need for a role of importance, status or value.
- **Search for identity:** With the rapidly shifting values in today's society, more people are looking for identity—a philosophy or cause which they can join.
- **Opportunity to be creative:** With computers, robots and other machines supplanting much human behavior and interaction, people may feel a need to have an avenue for expressing their creative ideas and expertise. This correlates with a teacher's needs as well.
- **Higher status:** Some volunteers may be seeking recognition which will elevate their community or company standing. They may even be conforming to the current service stance of their association. Even so, there are so many choices of action for the individual, that involvement in this particular volunteer program will include a basic sound endorsement and desire to help.
- **Humanitarianism:** Not the least of motivation is a true desire to help, to make a contribution. There is satisfaction in being a "good

citizen" and offering community service. There may also be a real concern about the pressing educational changes occurring nationally in the United States.

- **Enjoyment:** Volunteering can be fun—a part of the individual's social life, a better way to use leisure time. A volunteer does not need to have total commitment financially, politically, or of time and responsibility.

Opportunities abound for demonstrating appreciation of the volunteer's investment of time, energy and expertise. Recognition can be planned at a number of levels including:

Individual: From the teacher or from a student who has received personal attention, a short note or even a card is appropriate and welcome. Personal thanks either by phone or in school throughout the year sustains volunteer satisfaction. Let the volunteers know the level of success achieved with their help.

Class: Group letters or individual student thank-yous please a speaker or a field-trip leader/host. Consider a thank you story or small booklet composed of students' quotes or remarks (this is especially good for the lower grades).

Special Events: These can be arranged at a building level, school district level or community level. Everyone needs to feel appreciated. And even a certificate of appreciation is praise. (See Appendix 16.)

Be creative in planning recognition. Make use of pictures, plaques, or other mementos. Pictures of the volunteer "at work" are always welcomed. Some volunteer activities may have been videotaped. Provide the volunteer with a copy if this is available.

Recognition dinners, luncheons, or coffees are fine opportunities to express the thanks of teachers, students and the school community. A

volunteer breakfast can be an exciting event. Or plan a special Volunteer Program Day where students, teachers and volunteers together share their experiences and are recognized.

If a local business or governmental organization in the community hosts a volunteer recognition event, arrange to participate so that the school volunteers are honored too.

Publicity about volunteer efforts not only promote the program in the community and entice additional volunteer help, but serves to recognize the volunteers' contribution. Newspaper, radio and TV feature stories are more difficult to initiate. But it may be possible for the program to be a part of an educational focus story event.

School newsletters can carry volunteer recognition articles into every home. And, when appropriate, a letter of commendation sent to the volunteer's company or employer is often appreciated.

The teacher is the key to volunteer satisfaction and retention, by helping volunteers use their talents effectively. On a continuing basis, the climate created in the school can reward volunteers, as they receive:

- a warm welcome and a smile from the coordinator, office and teaching staff
- personal care in orientation to the building and classroom/students
- identity/visibility—through badges and introductions
- special support—hot coffee/cold drink, lunch invitation, inclusion in school events
- positive feedback about contributions: give credit when it is due
- establish a relationship through informal conversation
- recognition of reliability and dependability
- recognition of volunteer's efforts as part of the larger program and its goals
- time to answer questions, address problems

- opportunity to change, advance, try new ideas, learn new skills
- thank yous whenever possible

A nurturing school climate where staff, teachers and students alike provide a warm, friendly atmosphere of continuing recognition will satisfy volunteers and work to keep the volunteer program exciting, vital and growing. **Smile and express appreciation for volunteer participation.**

Evaluation

Continuing evaluation of the impact of a volunteer program should be based upon the goals/objectives agreed upon during program planning. Rather than documenting only program success, plan evaluation to identify achievement of goals/objectives and to plan for future success. Mechanisms need to also consider whether the volunteer program strategies are making any difference.

There are many quantitative indicators which can be built into the program such as:

- number of volunteers recruited
- number of teacher requests
- number of students impacted
- hours of volunteer service record for various areas: science, math, technology tutoring, field trips, lab help etc. (See Appendices 17.)
- demographics for areas of expertise offered by volunteers
- attendance/involvement in planning and evaluating team sessions
- improvement in student achievement level
- number of curricular supplements provided

While these indicators are important, the qualitative aspects of volunteer program evaluation should not be overlooked. These can include:

- attitude change—on the part of students/teachers/administrators
- development of student-volunteer relationships

- development of school-volunteer relationships
- development of community-school relationships
- career motivation

Use evaluation results to determine future development of the program. Have the goals of the program been met? Were resources satisfactory—both in number and quality? Was the structure/mechanism of the program efficient? Was there effective communication? Were those involved satisfied with the performance level—including themselves? What could be done to improve the program?

Include volunteers in this evaluation. Have teachers do self evaluation of their use of volunteer contributions. Have students evaluate the volunteer impact on their attitude, performance and general comfort level with the curricular material.

The program's evaluation plan might be designed around questions such as: How was teaching performance enhanced by interaction with the volunteers?

What student benefits and improvements resulted from interaction with the volunteers?

Did interactions with the volunteers influence students' attitudes about mathematics, science and technology?

Did the program increase the teachers' access to material resources and experts in the fields of science, mathematics and technology outside of the school environment?

How effective was the collaboration in regard to implementing and promoting the program and the recruitment of volunteers?

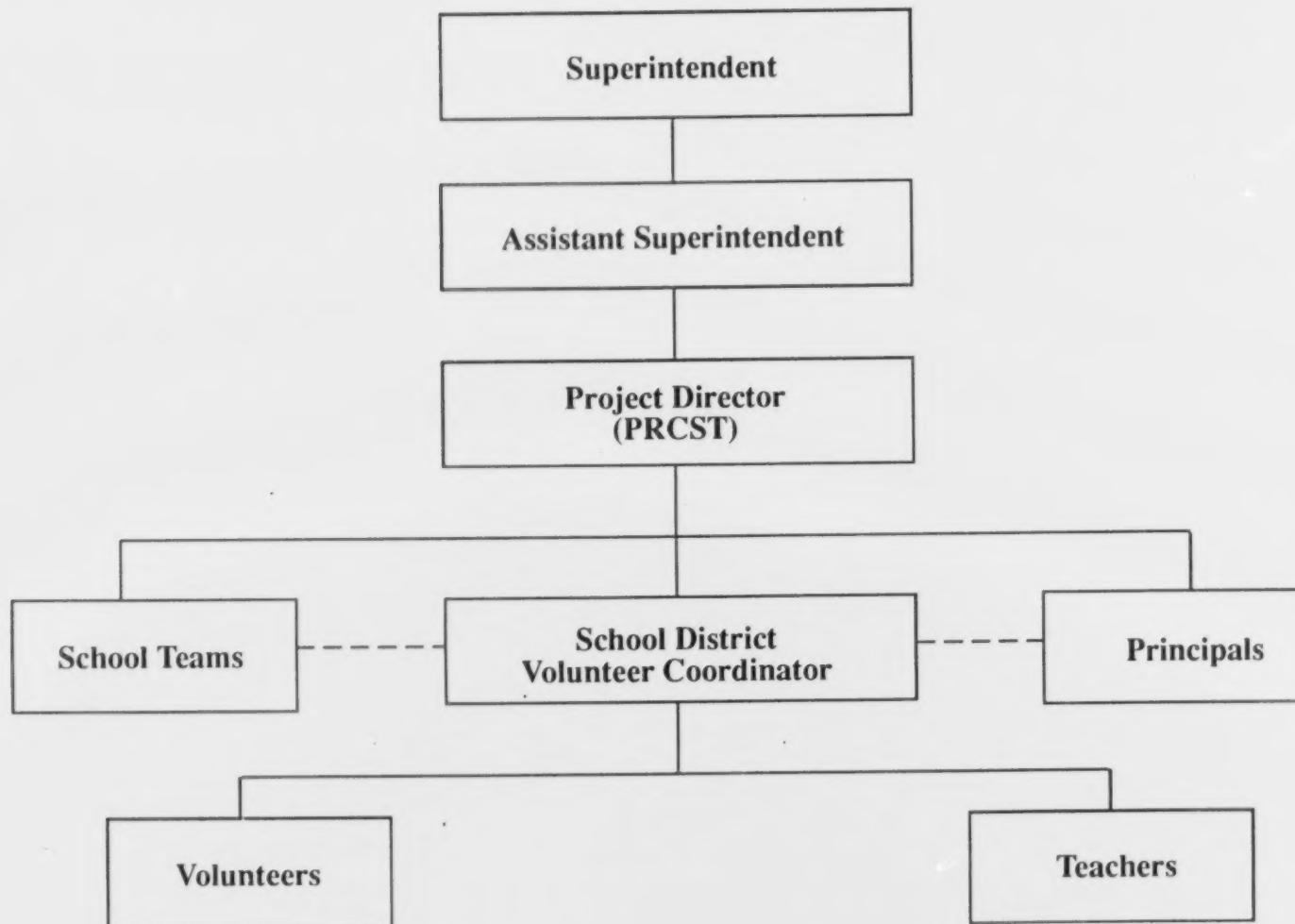
The impact of volunteer activities cannot always be measured immediately, just as teacher impact may not demonstrate itself for a long period of time. Give the program time to work and improve with use and develop-

ment. The program structure can be improved to provide greater efficiency and outcomes. The program will impact the community as well. Has the image of the school/curriculum/students/teachers/administrators been enhanced in the eyes of the community? Has the community involvement resulted in a closer identification of the community with their school district? Has the program offered tangible services to the community? Remember it is the quality of the total collaboration which measures the value of the volunteer program.

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Volunteers in Partnership Program Structure



Volunteer program
organization chart

Appendix 1

Appendix 2-1

Project TEAMS coordinator responsibilities

Identify and recruit professionals to assist teachers and interact with students. Training will be provided when appropriate.

Develop new partnerships with companies to increase resources for teachers and students.

Strengthen partnership with Naches Ranger District by coordinating efforts with participating schools when scheduling activities.

Assist teachers with determining how and when to use community resources in the classroom.

Provide volunteers for classroom presentations.

Provide teachers with resource materials and information.

Provide volunteers to assist MESA teachers with their curricula.

Assist teachers with arrangements for field trips.

Provide minority role models for MESA students.

Provide opportunities for MESA II and III students to increase their awareness

of career opportunities in mathematics, engineering, science and technology.

Provide information to students about employment opportunities through volunteers and their employers.

Provide presenters for the annual Minority Career Conference.

Provide presenters for Kirkwood Elementary School's annual science day.

Work with 4-H to enhance student exposure to mathematics, science and engineering projects and careers.

Assist Northwest College and University Association for Science with two of its programs:

- Classroom presentations given by Society of Women Engineers
- *Northwest Women in Science* (publication of women who are professionals in mathematics, science or engineering)

New and additional responsibilities

Assist the Triangle Coalition with the expansion of the National

School Volunteer Project by:

- serving as a member of the national advisory committee
- providing input for the revision of *A Guide for Building an Alliance for Science, Mathematics and Technology Education*
- participating in the training of coordinators at new project sites
- consult with coordinators of the new project sites to help them develop volunteer programs to meet site-specific needs

Provide assistance to Idaho's alliance for developing its statewide resource program.

Coordinate efforts with the Central Washington Science Alliance to assist its interested members with establishing mathematics and science volunteer programs.

Assist the community resources coordinator for the Northwest Center for Minorities Entering Science and Engineering with establishing the volunteer and resource segment of the program.

System-wide coordinators responsibilities

Help plan, schedule and develop goals for partnership activities.

Initiate and promote partnership activities.

Recruit schools, individual school coordinators and teachers.

Work with alliance to recruit business partners when needed; work with identified businesses and organizations and their coordinators to promote and develop partnerships.

Work with the alliance to recruit volunteers.

Help alliance provide or arrange for volunteer orientation and training.

Help teachers and volunteers structure individual partnership activities.

Help alliance match volunteers to specific school/teacher/classroom needs.

Arrange transportation for partnership activities.

Assure recognition of participants.

Establish and implement procedures for monitoring individual partnerships and provide trouble-shooting assistance as needed.

Provide progress reports and publicity (such as newsletters).

Establish a process for evaluating the partnership; give feedback; assist in developing and implementing changes to improve them.

Serve as contact point for communication between the alliance/advisory committee and the school teams.

Appendix 2-2

Coordinator and alliance responsibilities

In-school coordinator responsibilities

Help recruit teachers, students and volunteers for partnerships.

Serve as contact point for communication between system-wide coordinator and school administration, teachers, students and volunteers.

Serve as contact point for communication within the school among teachers, students and volunteers.

Provide orientation and assistance to volunteers.

Perform on-going coordination for school partnerships, including trouble-shooting.

Arrange for use of any school facilities or equipment or any transportation needs associated with school partnership activities.

Work with system-wide coordinator in performing responsibilities or perform some of those functions in place of the system-wide coordinator.

Business/organization coordinator responsibilities

Work with the school coordinator and possibly with teachers, to design and develop an appropriate partnership program.

Act as contact point between volunteers and school coordinator, teachers and/or students.

Recruit volunteers from business firms.

Help with training and orientation.

Help volunteers and their supervisors work out volunteer schedules that are mutually acceptable to the school and the business.

Arrange backups in the event the volunteer has to miss a session.

Help secure money for incidental expenses (such as supplies, transportation and awards).

Maintain contact with the school coordinator about on-going performance of the partnership and help perform trouble-shooting role.

Help provide recognition for volunteers.

Assist in providing recognition for participating school teachers and students, such as sending out letters of congratulations or arranging for awards, luncheons and other events.

Obtain publicity for the business/organization.

Alliance responsibilities

Promote partnerships in the business community and recruit businesses and organizations to participate in collaboration.

Develop partnership activities.

Publicize successful partnerships and provide recognition and incentives for the community to participate.

Recruit and train volunteers.

Provide political support to the school system to promote partnerships and devote school resources to helping them continue.

Appendix 3-1

Student attitudes toward science

A=Always	F=Frequently	S=Sometimes	R=Rarely	N=Never	A	F	S	R	N
Please circle the number which indicates your current feeling.					1	2	3	4	5
1. Science classes are fun.					1	2	3	4	5
2. Science classes increase my curiosity.					1	2	3	4	5
3. The things studied in science classes are useful to me in daily living.					1	2	3	4	5
4. Science classes help me test ideas I have.					1	2	3	4	5
5. Science classes are boring.					1	2	3	4	5
6. My science teacher frequently admits to not having answers to my questions.					1	2	3	4	5
7. Science classes provide me with skills to use outside of school.					1	2	3	4	5
8. My science class deals with the information produced by scientists.					1	2	3	4	5
9. Science classes are exciting.					1	2	3	4	5
10. Science classes provide a chance for me to follow up on questions I have.					1	2	3	4	5
11. Science teachers encourage me to question.					1	2	3	4	5
12. All people can/do/practice science.					1	2	3	4	5
13. Scientists discover information that is difficult to understand.					1	2	3	4	5
14. Being a scientist would be fun.					1	2	3	4	5
15. Being a scientist would be lonely.					1	2	3	4	5
16. Being a scientist would make a person rich.					1	2	3	4	5
17. Being a scientist would make a person feel important.					1	2	3	4	5
18. Being a scientist would mean giving up some of the things of interest.					1	2	3	4	5

Appendix 3-2

Administrator needs assessment

This information will help those planning the volunteer program to better match the needs of your school with the expertise, interests and skills of the volunteers and their resources.

name _____ position _____
school _____

I. General school district information

1. The area served by the school is primarily: ☐ urban ☐ suburban ☐ rural
2. The student enrollment is: ☐ under 200 ☐ under 500 ☐ 501 to 1,000 ☐ 1,001 to 3,500 ☐ over 3,501
3. The percent of students eligible for free or reduced lunch prices is: ☐ less than 10% ☐ 10 to 50% ☐ 51 to 80% ☐ over 80%
4. Has your school participated in any school volunteer programs in the past?
☐ yes ☐ no
5. If yes, please describe briefly. _____

6. Science/mathematics/technology volunteer resources the school presently accesses (check all that apply):
 - ☐ mentoring
 - ☐ student job training/internships
 - ☐ speakers bureau
 - ☐ faculty staff development
 - ☐ parent involvement
 - ☐ tours/field trips
 - ☐ summer teacher employment/internships
 - ☐ career information/shadowing/counseling
 - ☐ assistance with extracurricular activities
 - ☐ serving on education committee/task force
 - ☐ tutoring
 - ☐ demonstrations
 - ☐ use of facilities and equipment
 - ☐ scholarships/incentives/contests
 - ☐ school site improvement (i.e. field study area)
 - ☐ donation of materials/equipment
 - ☐ special assemblies/events
 - ☐ other _____

7. Activities/services provided, if any, by the school to volunteers (check all that apply):

- ☐ use of school facilities/equipment
- ☐ instruction by school staff (basic skills, language, retraining)
- ☐ recognition (awards, special events)
- ☐ career counseling
- ☐ adult education
- ☐ school staff assistance to community projects
- ☐ use of school site for activities
- ☐ community service (for elderly, handicapped, preschool, etc.)
- ☐ student performances (reduced price/free tickets to student athletic/arts events)
- ☐ other _____

8. Volunteer/partner organizations/individuals by source:

- ☐ large business (more than 500 employees)
- ☐ medium size business (50 to 500 employees)
- ☐ small business (less than 50 employees)
- ☐ business association (Chamber of Commerce, etc.)
- ☐ civic organization or service club
- ☐ labor organization
- ☐ foundation
- ☐ communications/media
- ☐ cultural organization (museums, etc.)
- ☐ health care organization
- ☐ armed service
- ☐ profession (law, engineering)
- ☐ college and university
- ☐ government agency
- ☐ religious organization
- ☐ public service (utility, transport)
- ☐ parent organization
- ☐ retiree organization
- ☐ public/private school
- ☐ other _____

Appendix 3-3

Teacher needs assessment

This information will help those planning the volunteer program to better match your needs with the expertise, interests and skills of the volunteers and their resources.

name (optional) _____
 school _____
 department/expertise (use fields of subjects from organizational survey) _____

1. What grades do you presently teach? 1-3 4-6 7 8 9

2. a. Have you participated in a similar program? ☐ yes ☐ no

b. Did you have contact with scientist and engineer volunteers for your instructional program (e.g. to speak on selected topics, do demonstrations)? ☐ yes ☐ no

c. If yes, please describe briefly. _____

3. How many years of teaching experience do you have? _____

4. In your instructional program how often per week or per semester do you use:

	per week	per semester
hands-on activities	_____	_____
audio/video programs	_____	_____
small group work	_____	_____
lecture presentation	_____	_____
open-ended activities	_____	_____

5. Please indicate (by circling the appropriate number) the extent to which you have a need for information/resources about each of the following (1=no need at all and 4=urgent need).

a. field trips	1	2	3	4
b. free/inexpensive instructional materials	1	2	3	4
c. independent science activities for students	1	2	3	4
d. update of technological development	1	2	3	4
e. special demonstrations	1	2	3	4
f. computer workshops – hardware	1	2	3	4
g. computer workshops – software	1	2	3	4
h. speakers on topics	1	2	3	4
i. advisors/consultants	1	2	3	4
j. special equipment or supplies for projects (e.g., Spectographs, fertilized eggs)	1	2	3	4
k. set-up of experiments	1	2	3	4
l. career information	1	2	3	4

6. Please rate your agreement with each of the statements below. Using the scale in the box, select the number that corresponds to the most appropriate phrase. Write the number to the left of each statement.

1=strongly agree
2=agree
3=unsure
4=disagree
5=strongly disagree

- _____ a. My knowledge of science concepts is adequate for the science instruction I am required to conduct.
- _____ b. I am able to acquire the needed science equipment and materials through my school.
- _____ c. I use a variety of hands-on activities for science instruction.
- _____ d. I use inexpensive, common items for science activities.
- _____ e. I am confident in teaching science to my students.
- _____ f. I am able to make science concepts understandable to all of my students.
- _____ g. I am able to demonstrate to students the usefulness of science in everyday life.
- _____ h. I have adequate planning time for science instruction.
- _____ i. I convey positive attitudes about the subject of science to my students.
- _____ j. I can adequately inform my students about career opportunities in the fields of science.
- _____ k. I will enhance my skills in science instruction by participating in the program.
- _____ l. I anticipate the program and will be involved regularly throughout the year.

Appendix 3-4

Community organization needs assessment

This information will help those planning the volunteer program to better match the expertise, interests and skills of your employees/members with requests by schools. It will also identify your needs that could be met by the program.

I. Organization information

name of organization: _____
address: _____
contact person: _____
position/title: _____
telephone: _____ best time to call _____

II. Organization specialties (please check all that apply)

fields of interest:

- | | | |
|--|---|---|
| ☐ general science | ☐ physics | ☐ technology |
| ☐ earth science | ☐ computer science | ☐ other |
| ☐ health | ☐ electronics | bilingual? ☐ yes ☐ no |
| ☐ biology | ☐ mathematics | language _____ |
| ☐ chemistry | | |

III. Preference levels for participation (please check all that apply)

students:

- | | |
|---|--|
| ☐ preschool/elementary | ☐ special education |
| ☐ middle | ☐ gifted and talented |
| ☐ secondary | ☐ administrators |
| | ☐ teachers |

IV. Previous organizational experience in education outreach (none required)

V. Location preference (name counties, school districts and why)

VI. Forseeable levels of organizational participation

(Use letters h=high, m=moderate, l=low, n=none)

- | | |
|--|--|
| ☐ regularly | ☐ occasionally |
| ☐ work with one student or just a few | ☐ work with large group or entire class |
| ☐ short-term (special project) | ☐ long-term (3 months or more) |
| ☐ work individually as a volunteer | ☐ work as part of a team of volunteers |

VII. Activity preferences (please check all that might apply)

- | | |
|--|---|
| ☐ tutoring | ☐ homework assistance |
| ☐ mentoring | ☐ present science and mathematics applications |
| ☐ enrichment activities | ☐ assist with debates or other issue presentations |
| ☐ do demonstrations | ☐ design and writing activities |
| ☐ speak on selected topics | ☐ serve on committee (science fair, curriculum, etc.) |
| ☐ teacher in-service | ☐ produce or loan videotapes or other audiovisuals |
| ☐ gather resource materials | ☐ assist with field trip (host, lead chaperone, sponsor) |
| ☐ assist with projects | ☐ expert resource consultant |
| ☐ help sponsor a club | ☐ loan/donate books or equipment |
| ☐ set up experiments | ☐ arrange teacher or student internships |
| ☐ teacher content updates | |
| ☐ provide career information (career fair/speaker/materials/counseling) | |
| ☐ prepare instructional aids (model, learning center or displays) | |

VIII. Recognition information

Please provide the format we should use in recognizing the participation of your organization in the program. Include only the appropriate information.

name of contact person: _____

name of organization: _____

address: _____

mission of organization: _____

national association of organization (if any): _____

suggested mechanisms: _____

Appendix 4

Program sequence

- I. Orientation meeting: entire staff
 department chairpersons
 staff members from selected departments
- II. Follow-up meeting to: explain volunteer recruitment procedure
 discuss possible types of activities/interactions
 with volunteers
 explain purpose of teacher statements
- III. Teachers submit their statements which explain their reasons for participating in Project TEAMS.
- IV. School volunteer program commences.

Appendix 5

Sampler of where to find volunteers

Science and Engineering

local sections of professional societies

- American Chemical Society—chemists
- American Geological Institute—geologists
- American Institute of Biological Sciences—biologists
- American Physical Society—physicists
- American Institute of Physics—physicists
- American Society of Mechanical Engineers—mechanical engineers
- Institute of Electrical and Electronics Engineers—electrical and electronics engineers
- National Association of Academies of Science—academies of science
- American Astronomical Society—astronomers
- Acoustical Society of America—acoustical scientists
- American Nuclear Society—nuclear scientists
- Federation of American Societies for Experimental Biology—experimental biologists
- health professionals

Business, Industry and Labor

- chambers of commerce
- trade associations
- industries and businesses
- labor unions

Education

universities and colleges

- presidents
- provosts
- vice presidents
- deans
- professors—research scientists
- professors—science and math education

local sections of professional associations

- American Association of Physics Teachers—physics teachers
- Association for Supervision and Curriculum Development—curriculum developers
- Association for the Education of Teachers in Science—university science teacher educators
- Association of Science-Technology Centers—science and technology centers
- Council for Elementary Science International—elementary science teachers
- Council of Chief State School Officers—state school officers
- Council of State Science Supervisors—state science supervisors
- International Technology Education Association—technology educators
- National Action Council for Minorities in Engineering, Inc.—precollege engineering programs
- National Association for Research in Science Teaching—science education researchers
- National Association of Biology Teachers—biology teachers
- National Association of Geology Teachers—geology teachers
- National Council of Teachers of Mathematics—mathematics teachers

- National Earth Science Teachers Association—earth science teachers
- National Energy Foundation—energy educators
- National Science Supervisors Association—district science supervisors
- National Science Teachers Association—science teachers
- Society for College Science Teachers—college science teachers
- National Association of Partners in Education, Inc.—school volunteers
- National Parent Teachers Association—parent teachers association
- state science, mathematics and technology teacher associations

Government

- science and mathematics supervisors
- governors science and technology committees
- economic development committees
- legislative representatives
- commissioners and executives
- city councilors

federal agencies

- U.S. Department of Agriculture—soil conservation, 4-H
- National Aeronautics and Space Administration—research facilities
- government laboratories
- congressional representatives

other groups

- museums
- service clubs—rotary
- media—radio, tv, print
- American Association of Retired Persons—retired persons
- Future Farmers of America—farmers
- alliances
- religious groups
- other community organizations

Appendix 6

Precollege programs and volunteer opportunities

Program	Audience	Grade	Volunteer Responsibility												Time	Special Qualifications
			Mentoring	Tutoring	Technical presentations	Career presentations	Club activities	Field trips	Administrative support	Contest judging	Contest coaching	Contest question development	Post-contest planning	Curriculum development		
Amateur Radio in the Classroom	A	6-12+	•	•	•	•	•	•				•	•		1,2	Amateur Radio License helpful
Big Sister and other mentor programs	F,M	7-12	•	•	•	•	•				•				2	Female Engineer/student
Bus./Indus./Educ. Joint Sch. Reform	A,T	K-12+		•			•					•	•	•	2	
Career Awareness Exploring	A	9-12			•										1	Practicing Engineer
Community Computers Learning Centers	D,F,M,T	K-12+		•			•					•	•		2	
Educational Outreach Program	A,T	K-12		•	•		•					•	•		1	Knowledge of nuclear science
Engineering Exploring	A	9-12+		•	•	•	•								1,2	Engineer
Expanding Your Horizons	F	6-12	•	•	•		•								1	Female scientists, engineers
Fnd. for Science & the Handicapped	D	9-12+	•	•	•		•					•			1,2	
4-H Club Sci-Tech Program	A	K-12		•	•	•	•	•							1,2	
Higher Education Outreach Program	F,M	8-12	•	•	•	•	•	•				•			1,2	Female Engineer/student
Int'l. Science & Engineering Fair	A	9-12	•	•	•	•	•	•							3	Varies
Leading Girls to Math, Science, and Technology (Contemporary Issues Series)	F	1-12		•	•	•	•								1,2	
Linkages Project	D,F,M	K-12		•			•								2	
Local Alliances for Science & Technology Education	A,T	K-12	•	•	•	•	•	•	•	•	•	•	•	•	1,2,3	
MATHCOUNTS	A	7-8					•	•	•	•	•	•	•	•	1,2,3	
NACME (Minorities in Engineering)	M	6-12	•	•	•	•	•	•	•	•	•	•	•	•	1,2,3	Engineer
Nat'l. Engineering Aptitude Search	A	9-12					•			•	•				3	Engineer preferred
Nat'l. Engineering Design Challenge	A	9-12					•	•	•	•	•				3	Engineering educ./exper.
National Engineers Week Discover"E"	A	K-12		•	•										1	Engineer
Odyssey of the Mind	A	K-12+					•	•	•						3	Knowledge specific problem
Operation SMART	F	1-12	•		•	•	•								2	Female engr./scientist
Science Books and Films Review Jnl.	A,T	K-12+										•			1	
Science Olympiad	A	1-12					•	•	•						3	Knowledge specific topic
Science, Technology, and Disability	P	K-12+										•			1	
Students Engaged in Engr. (SEE)	A	6-9		•	•	•	•								2	Practicing Consulting Engineer
TEAMS Competition	A	9-12					•		•	•	•				3	Engr. backgr. preferred
Textbook Review Program	A,T	K-12										•			1	Knowledge of nuclear science
U.S. Nat'l. Chemistry Olympiad	A	9-12					•								3	Chemist, Chem. Engineer
U.S. Skill Olympics	A	9-12		•	•	•	•	•	•	•					3	Electronics Technologist or Technician or expert in field
Young Scientists and Engineers	A	K-12	•	•			•	•	•	•	•				2	

A=all students D=disabled F=female M=minority P=print impaired T=teachers 1=occasional 2=ongoing 3=contest-related

Contact information

Amateur Radio in the Classroom
American Radio Relay League
(ARRL)
225 Main Street
Newington, CT 06111
(203) 666-1541

Big Sister Program
Society of Women Engineers (SWE)
345 East 47th Street
New York, NY 10017
(212) 705-7871
(908) 756-2419

Business/Industry/Education Joint
Efforts in School Reform,
Career Education and Human
Resources/Economic Development
National Association for Industry-
Education Cooperation (NAIEC)
235 Hendricks Blvd.
Buffalo, NY 14226-3304
(716) 834-7047

Career Awareness Exploring
Boy Scouts of America
P.O. Box 152079
Irving, TX 75015-2079
(214) 580-2428

Community Computers Learning
Centers
American Association for the
Advancement of Science (AAAS)
1333 H Street, NW
Washington, DC 20005-4792
(202) 326-6670

Educational Outreach Program
American Nuclear Society (ANS)
555 North Kensington Avenue
La Grange Park, IL 60525
(708) 579-8261

Engineering Exploring
Boy Scouts of America
P.O. Box 152079
Irving, TX 75015-2079
(214) 580-2429

Expanding Your Horizons
Math/Science Network
2727 College Avenue
Berkeley, CA 94705
(415) 841-MATH

Foundation for Science and the
Handicapped
236 Grand Street
Morgantown, WV 26505
(304) 293-5201

4-H Club Sci-Tech Program
Extension Service, U.S. Department of
Agriculture
Room 3860 South Building
Washington, DC 20250-0900
(202) 447-5516

Higher Education Outreach Program
Society of Women Engineers (SWE)
345 East 47th Street
New York, NY 10017
(212) 705-7871

International Science and Engineering
Fair (ISEF)
Science Service
1719 N St. N.W.
Washington, DC 20036
(202) 785-2255

Leading Girls to Mathematics, Science
and Technology
Contemporary Issues Series
Girl Scouts of the U.S.A.
830 Third Avenue
New York, NY 10021
Tel: local Girl Scouts Council

Linkages Project
American Association for the
Advancement of Science (AAAS)
1333 H Street NW
Washington, DC 20005-4792
(202) 326-6670

Alliances for Science and Technology
Education
Triangle Coalition for Science and
Technology Education
5112 Berwyn Road, 3rd Floor
College Park, MD 20740
(301) 220-0886

MATHCOUNTS
MATHCOUNTS Foundation
1420 King Street
Alexandria, VA 22314
(703) 684-2831
(703) 684-2859

National Action Coalition for
Minorities in Engineering
(NACME)
3 West 35th Street
New York, NY 10001
(212) 279-2626

National Engineering Aptitude Search
(NEAS)
Junior Engineering Technical Society
(JETS)
1420 King Street, Suite 405
Alexandria, VA 22314
(703) 5484-5387

National Engineering Design
Challenge
Junior Engineering Technical Society
(JETS)
1420 King Street, Suite 405
Alexandria, VA 22314
(703) 548-5387

National Engineers Week Discover
"E" project

National Engineers Week
Headquarters
1420 King Street
Alexandria, VA 22314
(703) 684-2852

Odyssey of the Mind
OM Association
P.O. Box 27
Glassboro, NJ 08028
(609) 881-1603

Operation SMART
Girls Club of America
30 East 33rd Street
New York, NY 10016
(212) 689-3700

Science Books and Films
American Association for the
Advancement of Science (AAAS)
1333 H Street, NW
Washington, DC 20005-4792
(202) 326-6670

Science Olympiad
5955 Little Pine Lane
Rochester, MI 48064
(313) 651-4013
(313) 286-8800 ext. 242

Science, Technology and Disability
Project
American Association for the
Advancement of Science (AAAS)
1333 H Street, NW
Washington, DC 20005-4792
(202) 326-6670

Students Engaged in Engineering
(SEE) Program

American Consulting Engineers
Council (ACEC)
1015 15th Street NW Suite 802
Washington, DC 20005
(202) 347-7474

Tests of Engineering Aptitude,
Mathematics and Science (TEAMS
Competition)
Junior Engineering Technical Society
(JETS)
1420 King Street, Suite 405
Alexandria, VA 22314
(703) 5484-5387

Textbook Review Program
American Nuclear Society (ANS)
555 North Kensington Avenue
La Grange Park, IL 60525
(708) 579-8261

U.S. National Chemistry Olympiad
American Chemical Society (ACS)
1155 16th Street NW
Washington, DC 20036
(202) 872-4382 or (202) 872-4590

U.S. Skills Olympics
Vocational Industrial Clubs of
America (VICA)
P.O. Box 3000 Route 15
Leesburg, VA 22075
(703) 777-8810

Young Scientists and Engineers
Young Scientists and Engineers
Foundation
P.O. Box 3084
Sierra Vista, AZ 85636-3084
(602) 458-1560

Appendix 7

Wanted: Volunteers for local schools

Today's image of volunteers is one of diversity and depth. Labor markets (and increased access by women to these markets), population shifts, legislation and strong and rapid shifts in lifestyles have diminished the standard pool of volunteers long available to schools. Conversely, access to new volunteer groups has increased (retired persons, college students, business professionals and executives on released time).

Fast-paced developments in science and technology, declining enrollments, desegregation, mainstreaming, shrinkage of the science teacher pool and budget restraints have all placed considerable stress on the educational community as well.

National attention throughout the 1980s has been directed at the quality of science, mathematics and technology education in the United States. Competing poorly on a global level, our students reflect an educational system in need. Dozens of studies, commissions and mandates have addressed the problem and offered potential solutions.

The most encouraging of these are partnerships or collaborative efforts between schools and community organizations—partnerships which enlist a new force of volunteers working in new ways within the school systems.

Volunteers in Partnership (VIP) seeks those volunteers who:

- understand the schools' strengths and problems
- understand how important schools are to the well-being of communities and the nation's future economy
- bring a new level of professionalism to the partnership
- can act as positive role models to students
- can match community resources to needs identified by the school system or teachers

Volunteers are strongly encouraged to attend all orientation and training programs offered by the Pittsburgh Regional Center for Science Teachers (PRCST) or the school systems involved in the project. Only a team effort will result in satisfaction of all partners. These programs are meant to help you feel more comfortable in the volunteer role and to provide you with information to enhance the success of the program.

Your willingness to share expertise, time and effort to increase educational opportunities for today's students is greatly appreciated.

PRCST, the school systems and all the team members will work with you to provide a successful, rewarding and satisfying experience.

Volunteer application

This information allows us to match your expertise, interest and skills with requests from teachers for volunteers. It will also assist us in recognizing your volunteer efforts through your employer and professional associations and societies.

I. Personal information

name: _____
 preferred mailing address: _____

employer: _____
 position/title: _____
 employment address: _____

telephone: _____ (o) _____ (h) _____
 brief description of your job: _____

job-related expertise: _____

Fields of interest:

- | | | |
|---|---|---|
| ☐ general science | ☐ chemistry | ☐ technology |
| ☐ physical science | ☐ physics | special skills _____ |
| ☐ earth science | ☐ computer science | special interests _____ |
| ☐ health | ☐ mathematics | bilingual? ☐ yes ☐ no |
| ☐ biology | ☐ electronics | language _____ |

II. Placement information: check preference of student level

- | | |
|---|--|
| ☐ preschool/elementary | ☐ special education |
| ☐ middle | ☐ gifted and talented |
| ☐ secondary | ☐ any |

time preference: can serve: _____ # days _____ best days
 _____ max. # hours/day

- ☐ morning _____
☐ afternoon _____
☐ evening _____
☐ Saturday _____

location preference: name counties, school districts

Activity preferences:

- | | |
|--|--|
| ☐ tutoring | ☐ provide simulated job interviews |
| ☐ mentoring | ☐ homework assistance |
| ☐ enrichment activities | ☐ shadowing |
| ☐ do demonstrations | ☐ writing activities |
| ☐ speak on selected topics | ☐ set up experiments |
| ☐ teacher in-service | ☐ present oral or living histories |
| ☐ curriculum advisor | ☐ teacher content updates |
| ☐ gather resource materials | ☐ expert resource consultant |
| ☐ assist with projects | ☐ loan/donate books or equipment |
| ☐ help sponsor a club | ☐ arrange teacher or student internships |
| ☐ host a field trip | ☐ serve on committee (science fair, etc.) |
-
- ☐ arrange equipment loan, on-and off-site
 - ☐ present science and mathematics applications
 - ☐ assist with debates or other presentations of issues
 - ☐ produce or loan videotapes or other audiovisuals
 - ☐ provide career information (career fair/speaker/materials/counseling)
 - ☐ prepare instructional aids (model, learning center, or displays)

Prefer to volunteer:

- | | |
|--|--|
| ☐ regularly | ☐ occasionally |
| ☐ work with one student or just a few | ☐ work with large group or entire class |
| ☐ short-term (special project) | ☐ long-term (3 months or more) |
| ☐ work individually as a volunteer | ☐ work as part of a team of volunteers |

III. Recognition information

Who should be recognized for allowing you time away from your regular position to volunteer?

name: _____
address: _____

To what professional societies and associations do you belong?

I learned about this project from:

Return to: _____

For information only

Appendix 9

Volunteer registration form

name: _____
preferred mailing address: _____

telephone: _____ (o) _____ (h)

education: _____
last degree earned _____ year _____
school _____

marital status: circle one
S M W D
children: # boys _____ # girls _____
children in school _____
ages _____

list previous volunteer work (organization and job description)

Why do you want to participate in the VIP Program?

In case of emergency please notify: _____

Best time to call: _____

health status (limitations, allergies, etc.) _____

Interviewer's Signature _____ *Date* _____

school or school district _____

comments: _____

The Volunteer Project

The **National School Volunteer Project in Science, Mathematics and Technology** identifies and mobilizes scientists, mathematicians, engineers and technical people from business, industry, government and higher education to work with teachers and students. The project targets precollege education, grades kindergarten through twelve and is partially supported by a grant from the **National Science Foundation**.

Volunteers provide opportunities for intellectual stimulation and professional growth for teachers, support instructional activities and offer enrichment opportunities for students. Teaching experience is not needed. Teachers are always present with the volunteer in the classroom. Through the project activities, volunteers support professional educators in the task of providing a quality education for each student.

The Local Sites

The local sites will mobilize the resources of the Triangle Coalition's national membership, local collaboratives around the country and Engineers for Education's national membership of over forty societies. In 1992 the project will involve over 20 project sites and perfect pilot training procedures and materials. By 1993 at least 100 additional sites will be using these procedures and materials.

The Triangle Coalition

The Triangle Coalition brings together over 100 national organizations from business, industry and labor; science and engineering; and education for the purpose of improving science and technology education for all students. Through this project, the Triangle Coalition will use its resources to identify and mobilize local cadres of effective volunteers, who, working with and under the direction of teachers, will help teachers expand and give more practical context to their students' science and mathematics experiences.

Engineers for Education

Engineers for Education is a non-profit association of more than forty engineering professional societies dedicated to recruiting engineers as volunteers to promote mathematics and science education.

Local Project Coordinators

The project coordinator in your area or the Triangle Coalition can answer your questions and provide more information. Please return your volunteer form, call or write:

Triangle Coalition for Science and Technology Education
Attn: National School Volunteer Project
5112 Berwyn Road, 3rd Floor, College Park, MD 20740
(301) 220-0885 or 220-0886/ FAX (301) 474-4381

The current sites are:

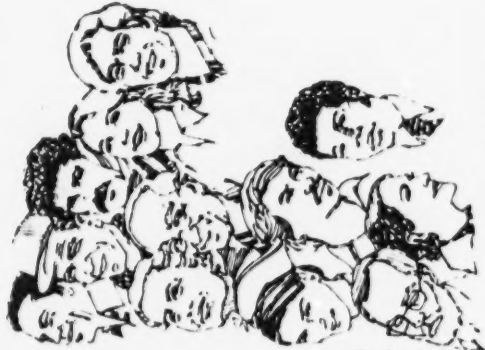
Anchorage, Alaska
Phoenix, Arizona
Arkadelphia, Arkansas
Los Angeles, California
Atlanta, Georgia
Fort Hall, Idaho
Chicago, Illinois
Baton Rouge, Louisiana
Woods Hole, Massachusetts
Kalamazoo, Michigan
Moorehead, Minnesota
Jackson, Mississippi
New York, New York
Raleigh, North Carolina
Canton, Ohio
Allegheny County, Pennsylvania
Providence, Rhode Island
Houston, Texas
Salt Lake City, Utah
Newport News, Virginia
Puget Sound Region, Washington
Green Bay, Wisconsin

WANTED: Science, Mathematics and Technology Volunteers in your area

In cooperation with:
Triangle Coalition for Science and Technology Education

An opportunity for you to enhance education for students in your area

Volunteer brochure



Volunteer Today!

To volunteer or learn more about how you can help, return this completed form to the appropriate local coordinator or to the address below:

- ☐ Yes, I want to participate in the National School Volunteer Project in Science, Mathematics and Technology Education.
- ☐ Please send me more information about the program.

You can write or call me at:

Name _____ Position/Title _____

Employer _____ Location _____

Preferred Mailing Address _____

City _____ State _____ Zip _____

Home Telephone _____ Office Telephone _____

Your Field of Specialization or Interest _____

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Triangle Coalition for Science and Technology Education
Attn: National School Volunteer Project
5112 Berwyn Road, 3rd Floor, College Park, MD 20740
(301) 220-0886 or 220-0886/ FAX (301) 474-4381

Volunteer to Enrich Learning

You can volunteer and make a difference by offering:

- **your expertise**
- **your energy**
- **your skills**
- **your interest**

Your skills, work, hobbies and knowledge can add excitement to students' learning experiences. You can also provide content updates, enhance instructional strategies and support program development mechanisms for teachers in your community.

The project will match your talents with teachers' needs. Engineers, technicians, mathematicians and scientists from business, industry, government and higher education are eligible to participate.

Volunteers will work with and under the direction of teachers. Special emphasis will be placed upon minority and women volunteers as role models for students and on the needs of elementary science teachers.

You can:

- **Communicate** understanding of the scientific world
- **Broaden** knowledge and requirements for science-related careers
- **Extend and enrich** learning opportunities for both students and teachers
- **Generate** enthusiasm and **promote** positive attitudes toward science among students.

What You Can Do

A few of the distinctive ways you can offer valuable service to your area's students and teachers are listed below:

- **Present** demonstration experiments
- **Work** with students on developing problem-solving skills
- **Conduct** briefings, seminars and workshops
- **Act** as a mentor or advisor for a student
- **Organize** or **host** field trips
- **Make** presentations or displays
- **Host** an intern
- **Build** student self-esteem
- **Help** students set goals and achieve them
- **Provide** "shadowing" opportunities for students
- **Loan** equipment or other materials
- **Provide** practical help on the use and repair of equipment
- **Assist** with science fairs
- **Assist** in career exploration activities
- **Tutor** students
- **Share** special interests or expertise.

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Appendix 10-2



WANTED:

Science, Mathematics and Technology Volunteers

An opportunity for you to enhance education for students in your area

In cooperation with:

Triangle
Coalition
for
Science
and
Technology
Education



Volunteer Today!

To volunteer or learn more about how you can help, return this completed form to the appropriate local coordinator or to the address below:

☐ Yes, I want to participate in the National School Volunteer Project in Science, Mathematics and Technology Education.

☐ Please send me more information about the program.

You can write or call me at:

Name Position/Title

Employer Location

Preferred Mailing Address

City State Zip

Home Telephone Office Telephone

Your Field of Specialization or Interest

Triangle Coalition for Science
and Technology Education
Attn: National School Volunteer Project
5112 Berwyn Road, 3rd Floor
College Park, MD 20740

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The National School Volunteer Project in Science, Mathematics and Technology identifies and mobilizes scientists, mathematicians, engineers and technical people from business, industry, government and higher education to work with teachers and students. The project targets precollege education, grades kindergarten through twelve and is partially supported by a grant from the National Science Foundation.

Volunteers provide opportunities for intellectual stimulation and professional growth for teachers, support instructional activities and offer enrichment opportunities for students. Teaching experience is not needed. Teachers are always present with the volunteer in the classroom. Through the project activities, volunteers support professional educators in the task of providing a quality education for each student.

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- Broaden knowledge and requirements for science-related careers
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- Act as a mentor or advisor for a student
- Organize or host field trips
- Make presentations or displays
- Host an intern
- Build student self-esteem
- Help students set goals and achieve them
- Provide "shadowing" opportunities for students
- Loan equipment or other materials
- Provide practical help on the use and repair of equipment
- Assist with science fairs
- Assist in career exploration activities
- Tutor students
- Share special interests or expertise.

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Triangle Coalition for Science and Technology Education
Attn: National School Volunteer Project
5112 Berwyn Road, 3rd Floor, College Park, MD 20740
(301) 220-0885 or 220-0886 FAX (301) 474-4381

The current sites are: Anchorage, Alaska; Phoenix, Arizona; Arkadelphia, Arkansas; Los Angeles, California; Atlanta, Georgia; Fort Hall, Idaho; Chicago, Illinois; Baton Rouge, Louisiana; Woods Hole, Massachusetts; Kalamazoo, Michigan; Moorhead, Minnesota; Jackson, Mississippi; New York, New York; Raleigh, North Carolina; Canton, Ohio; Allegheny County, Pennsylvania; Providence, Rhode Island; Houston, Texas; Salt Lake City, Utah; Newport News, Virginia; Puget Sound Region, Washington; and Green Bay, Wisconsin.

What can I expect from...

a five year old...

Is helpful around the house
Prefers mother over father
Needs some assistance with coats and other things
Is close-mouthed at home about school activities
Has short bursts of energy
Changes from one activity to another with relative ease
Has vague concepts of time
Is not fearful
Asks many questions about how things work
Enjoys cutting and pasting
Loves to play dress-up

a six year old...

Handles and attempts to use tools and materials
Is self-centered, domineering, stubborn and aggressive
Wants and needs to be first, to be loved best, to be praised most and to win
Is usually better-behaved away from home
Does a good deal of tattling
Is very domineering and bossy
Is interested in simple games
Carries on long conversations
Enjoys father
Is restless, overactive and exuberant
Usually likes his teacher

a seven year old...

Does not respond promptly
May forget easily
Fights with playmates
Plays in pairs or in groups
Is interested in magic, puzzles, collecting and exchanging baseball cards
Girls like dress-up, paper dolls and jumping rope
Is concerned about being good
Is easier to discipline, sensitive to praise
Complains and sulks
Allow teacher supremacy in school

Appendix 11

Developmental Characteristics

an eight year old...

Is money mad
Makes fewer complaints about teacher
Is expansive and speedy
Attention span is improving
Is alert, friendly and interested in people but sometimes careless, noisy and argumentative
Has feelings easily hurt by careless remarks
Understands time and money concepts
Likes team games
Is critical of brothers and sisters
Needs frequent reminders about responsibilities
Is demanding of mother
Is sensitive to criticism
Needs adult praise and encouragement

a nine year old...

Has new forms of self-independence
Has increasing self-motivation
Resents interruptions
Likes secret codes and languages
Has strong sense of right and wrong
Is easily discouraged
Is competitive in work and in play and is afraid of failure
Cries only when emotions are over-taxed
Is a great worrier
Is anxious to please
Makes fewer demands on parents
Is a loyal and devoted friend
Is more interested in talking and listening than working

a ten year old...

Is relaxed, casual and alert
Is in one of the happiest ages
Has a strong sense of justice
Truly enjoys friends
Needs schedules
Loves the outdoors
Is a hero worshipper
Begins critical analysis of teacher
Wants teacher to be fair

pre-adolescents are...

Awkward, lazy and restless because of rapid and uneven growth
Very antagonistic and teasing toward the opposite sex
Often over-critical, rebellious and uncooperative
In need of warm affection and a sense of humor from adults
Turned off by nagging, condemnation and being talked down to
In need of a feeling of belonging and acceptance
In need of increasing opportunities for independence

adolescents...

Often go to extremes, are emotionally instable and know-it-alls
Have tremendous variations in attainment of physical maturity
Acquire an adult capacity for abstract thinking
Use aggressiveness in seeking independence
Commonly have conflicts with adults
Resent conditions that make them dependent on adults
Have difficulty adjusting to the inconsistencies and hypocrisies of adult society
Are oversensitive; indulge in self-pity and have intense fear of ridicule
Are concerned about popularity
Go to extremes in activities, thinking and emotional reactions
Become attached to worthy causes and are idealistic in value judgments
Show an acute sense of injustice
Tend to oversimplify
Are very interested in philosophical, ethical and religious problems
Show a step toward adulthood by asserting independence
Are in need of adult guidance that is kindly and does not threaten freedom
Seek both dependence and independence
Are in need of a constructive recreation, possibly a worthy cause

Appendix 12-1

Tips to volunteers

Be prepared

Have materials you need; confine your presentation to the objectives of the job description.

Arrive promptly

Arrive a few minutes early to sign in and find your way around the building.

If you must cancel

Notify the teacher as soon as possible. The students expect you too.

Remain professional

Students will not appreciate advertisements or sales pitches.

Summarize

Help students select important aspects of your presentation. Allow time for questions.

Evaluate

Take time to carefully evaluate the volunteer encounter and the impact of your presentation or involvement.

Enjoy yourself

Enthusiasm is the key!

Qualifications

- ☐ patience
- ☐ good health
- ☐ sense of humor
- ☐ sincerity
- ☐ flexibility
- ☐ enthusiasm
- ☐ understanding
- ☐ warmth
- ☐ reliability
- ☐ dependability
- ☐ willingness to accept supervision
- ☐ desire to motivate students
- ☐ respect for students and teachers
- ☐ special education and/or skills in science/mathematics

Benefits

- the satisfaction of bringing "today's world" into the classroom
- watching students come up to grade level
- satisfaction in sharing a talent or special knowledge
- knowing you are needed and useful
- keeping active a seldom used skill
- experiencing achievement in a successful program
- gaining experience to be used in other situations
- tax deductions may be claimed for all unreimbursed, out-of-pocket travel expenses for work assignments (cost of public transportation, mileage allowance for private vehicles, tolls and parking). For the latest information, check with your local Internal Revenue Service office.

Appendix 12-2

Tips for volunteers

- Talk to the teacher ahead of time. Be clear on what it is the teacher would like you to do. Ask for pertinent information about the student(s) you will work with.
- Check in at the school office when you arrive.
- Relax and enjoy yourself. The teacher will remain in the classroom with you and is responsible for student conduct.
- Overplan. It is better to have too much to say or do than too little.
- Vary your approach. Try various techniques to get your message across—visual aids, question and answer sessions, group discussions, problem solving, hands-on experience.
- Encourage students to do their own thinking. Give them plenty of time to answer; silence might mean they are thinking and organizing what they want to say or write.
- If you don't know an answer or are unsure of what to do, admit it to the students and work it out together. Ask the teacher for help when you need it.
- Use tact and positive comments. Encourage students. Seek something worthy of a compliment, especially when students are having difficulties.
- Accept each student as he or she is. Do not feel responsible for judging a student's abilities, progress or behavior.
- Respect a student's privacy. If a student or a teacher reveals personal information, keep it as a confidence.
- Maintain a sense of humor.
- Be consistent with rules for classroom behavior, schedule and atmosphere.
- Be professional. If parents and friends ask you about your work, tell them you enjoy working with students and discuss the activities you do rather than specific information about the students, the teacher or the school.
- Keep your commitment. The students look forward to your coming to their school. If you know you will be absent, tell them in advance. Keep all promises and make none that you cannot keep.
- The volunteer has a right to expect clear direction on the purpose of his/her visit and access to available equipment. You may ask for an evaluation from either the teacher or the students.

Appendix 12-3

A successful volunteer

- Signs in upon arrival.
- Understands how important he or she is and only accepts those assignments which he or she can realistically fulfill.
- Serves as a liaison between the program and other community resources.
- Wears the Volunteers in Partnership identification tag.
- Acts as a role model, sharing career information whenever possible and encouraging students.
- Remembers that the teacher is in charge of the classroom.
- Is reliable—please call the school and inform the teacher if you cannot come for any reason. Students are depending upon you, too.
- Evaluates the volunteer encounter, considering the needs and constraints of the situation.
- Supports the teacher in all situations.
- Is prompt—the bell rings whether you are there or not.
- Works with the volunteer or project coordinator on problems which arise.
- Knows that special information about teachers and students is always confidential and keeps observations on a professional level.
- Addresses the request at a specific level—talking with the teacher about the learning objectives and students' ability levels.
- Offers suggestions for enhancement or expansion of the program.
- Follows the teacher's plans.
- Signs out upon completing assignment.

Get ready!

Before you go into the classroom...

- *Prepare your activity based on children's needs and abilities.* Ask the teacher what students already know. "Typical Science and Technology Topics" on page 6 will give you a general understanding of what students typically learn at different grades. You can also check with the teacher about local curriculum and/or texts.

Know the age of the class you are visiting and their thinking and learning characteristics.

Get set!

- *Assemble your notes and materials in advance.* If each student is to have a handout or materials, make sure you have enough of each. See that materials are organized. Do a test run of experiments, games or any other activities you plan to do.
- *Prepare to use terminology that is appropriate for the students.* If there are a number of words or concepts students would benefit by knowing in advance, give them to the teacher and (s)he can help students learn them.
- *Allow yourself enough time to get to the school and to find the classroom.*

Go!

- *Share yourself.* Let the children know you are a real person with a family, pets, hobbies. Talk about how you got to be a chemist, an anthropologist, an engineer. Was there a special event or person in your life—a teacher, a learning experience, a book, a visit to a museum—that aroused your interest in your field? What do you do on an average day? What is interesting or unique about your work?

Appendix 12-4

The volunteer experience

- *Involve the students in doing.* Bring an attention grabber if you can. Keep in mind that your goal is to arouse curiosity, excitement, eagerness to know more. The tools of your profession may be commonplace to you, but they are mysterious, unknown, even fascinating to most of the students (and teachers) you meet. When possible, let students handle models, equipment, samples, plants, prisms, stethoscopes, rocks or fossils.
- *Involve students in the process of science.* Do a simple experiment in which the students participate. The process skills of science—observing, identifying, classifying, measuring—are the skills that enable students to apply science to everyday problems.
- *Stimulate thinking by asking questions.* Questions that ask students to make a prediction, to give an explanation, to state an opinion or to draw a conclusion are especially valuable. Be sure to allow time for each student to think before anyone gives answers.
- *Use language the students will understand.* Be conscious of vocabulary. Try not to use a difficult word when a simple one will do. Define words students may not know. For example, don't say, "I am a cytologist" and begin a lecture on semipermeable cell walls. Rather, ask students if they know what a cell is and then tell them you

study cells, how they are built and how they act and that you are called a cytologist.

- *Make what you are talking about real to the students.* Show the students that the area of science or technology you work with every day is part of their everyday lives, too. How has what you and your colleagues have learned up to this time changed how we do things or understand things? How will what you do make the students' lives better or different in the future? How does what you do and know relate to what they are learning in school?
- *Prepare the students for the unexpected, if appropriate.* Unexpected loud noises, bright lights, unusual odors, graphic photographs and similar experiences that evoke strong emotion or fright can disturb some children. It may be wise to warn students that a surprise or something unusual is coming even when evoking a degree of surprise is one part of your goal.
- *Leave more than a memory behind you.* Help set up an experiment that students can continue after you leave. Hand out an assignment—find out how many birds live in the local area, gather samples of leaves from local trees, make a cardboard glider—for the students to complete on their own or with their families. Invite them to write to you with questions—and plan on answering those letters quickly!
- *Ask for an evaluation of your efforts.* Ask the students what they liked (and didn't like) about your visit. Ask the teacher to critique your presentation and help you improve your in-class skills.
- *Schedule your next visit!*

Appendix 12-5

Tips on making a presentation

Do

Make eye contact with the students.

Smile and feel comfortable telling amusing anecdotes.

Organize all materials in advance.

Use student volunteers to help you set up and distribute materials, samples, pictures and handouts.

Require that students raise their hands to participate.

Call on many different members of the class.

Model good safety practices.

Give specific directions when distributing specimens.

Use a prearranged signal to get students' attention during activities (raising your hand, etc.).

Stop and wait for students to let you continue speaking if they get noisy.

Give handouts to students if it is a good time for the students to look at them or if you want them to use the handouts for an activity.

Wait several seconds before calling on students to answer a question.

Praise attentive or helpful behavior.

Enjoy the students, their enthusiasm, and their sense of wonder

Because

They love the personal contact.

Kids love a good laugh.

Kids sometimes have a hard time waiting.

Kids love to feel important.

They will probably all want to talk at once.

Everyone wants to be involved.

Kids learn by following role models.

Kids sometimes disagree about who has been holding an object the longest.

It is hard to give good directions unless students are quiet.

They have probably heard the "cold silence" before and know that it means they need to be less noisy.

If the students have the handouts while you are speaking they will be distracted.

The whole class needs time to think about the question before someone answers it.

This is the behavior you want to encourage.

They have a fascinating perspective on the world.

Appendix 12-6

Typical science and technology topics

	Kindergarten	First and second	Third and fourth	Fifth and sixth
Animals	Many kinds have different coverings Eat different kinds of foods	Are alike and different Move and grow Different homes Different sounds Care of pets	Adaptations to the environment Defense mechanisms Helpful and harmful animals	Animal classification Selective breeding Interaction with the environment Balance of nature
Plants	Many kinds Grow in different places Vegetables and fruits	Characteristics of plants Collecting parts of plants Seeds become plants Uses of plants	Classification of plants Effect of soil, water, air and light on growth Conservation Prehistoric plants	Parts and functions Life processes Plant movements Adaptation
Weather	Days can be sunny, cloudy, rainy and snowy Four seasons	Air occupies space, has weight Atmosphere Air has pressure Wind is moving air	Effect of sun on earth Temperature and thermometers	Evaporation and condensation Precipitation Air masses Forecasting and instruments Factors affecting climate
Physical and Chemical Properties	Things have colors, sizes, shapes Classifying objects Hot and cold Serial ordering	States of matter Different types of matter Dissolving Movement of things in air, water Sinking and floating	Expansion and contraction Heat Fuels Producing sound Music	Atoms Chemicals Mixtures and compounds Matter and energy Sources of energy Reflection/refraction Lenses
Electricity Magnetism		Sources of electricity Uses of electricity Safety	Magnets Simple compass Use of magnets	Static electricity Nature of electricity Simple circuit Batteries Series and parallel circuits Safety
Earth & Space Science	Moon Day and night Water Soil	Sun, moon, earth Stars Day and night	Heat and light Seasons Day, night, year Tides and eclipses Solar system Gravity, inertia and orbit Comets, meteors and meteorites Space exploration	Ecology Pollution Recycling Constellations Space travel Flight Oceans Water cycle Properties of water

Appendix 12-7

Thinking and learning characteristics of young people

Early Elementary (K-2)

As a thinker...

- Learns through manipulating objects.
- Believes what he or she sees.
- Can't trace steps back from a conclusion.
- Sees parts, not the whole.
- Does not understand that making physical changes in an object does not change its amount.

As a learner...

- Is expansive, adventurous, curious, eager to learn, energetic, always in motion, loud and emotional—has mood swings.
- Wants to please adults.
- Has difficulty controlling impulses and regulating behavior.
- Is very "me" centered. Seeks attention. Loves praise.
- Likes to work in groups, but will need assistance.
- Can sit still and listen 10-15 minutes; needs frequent change of pace.

Late Elementary (3-5)

As a thinker...

- Although still somewhat tied to seeing in order to believe, begins to understand concepts as well as objects.
- Understands hierarchical classification systems.
- Can combine, sort, multiply, substitute, divide.
- Begins to generalize, formulate hypotheses, use systematic problem solving strategies.
- Likes to memorize, to learn facts.

As a learner...

- Understands rules and can follow them.
- Likes group activities and excursions.
- Is a great socializer and eager to fit in.
- Considers fairness to be important.
- Takes initiative and is self-motivated.
- Is becoming and independent learner.
- Is a perfectionist who will practice the same thing over and over again.
- Avoids opposite sex.
- Can sit still and listen 20-30 minutes (variety increases attention span).

Middle Grades (6-8)

As a thinker...

- Can hypothesize, create propositions and evaluate.
- Can conceptualize in the abstract and understand probability.
- Begins to understand multiple causation.
- Developing understanding of ethical principles.

As a learner...

- Is emotional, restive and eager to get moving.
- Is easily bored.
- Challenges rules, routines and authority.
- Is beginning to have an interest in the opposite sex.
- Is typically more oriented to small group activity.
- Has a vulnerable ego, is very self-conscious and concerned about how he/she is perceived by others.
- Can handle 30-40 minute sessions.

Appendix 13-1

Tips for teachers working with volunteers

Volunteers will come from a wide variety of backgrounds. You as a teacher will want to help the volunteer understand your teaching standards and performance. Your responsibilities to the volunteer include the following:

1. Take time to talk with the volunteer outside the classroom, explaining class procedures, schedules, expectations and objectives.
2. Prepare the volunteer with specifics about the assignment, where materials can be found and what the learning objectives are.
3. Make the volunteer comfortable by explaining the obvious support facilities—where to place personal items, find a restroom and get a cup of coffee.
4. Plan in advance if the volunteer comes on a regular basis—volunteers have other things to do and cannot be expected to wait for an assignment or materials preparation.
5. Keep a special folder for regular volunteers with current assignments.
6. Inform volunteers about the students' level of ability, special problems and students who need assistance.
7. Inform any volunteer of a schedule change as soon as possible.
8. Understand when a volunteer is unable to fulfill an assignment. Use the established communication network to keep posted on availability. Keep open channels of communication with the volunteer; exchange home numbers if convenient.
9. Encourage your volunteer to sign in and out and to wear the name tag. Other faculty members and administrators will want to acknowledge a volunteer in the building.
10. Let every volunteer know how much you and the class appreciate the help. **A thank-you note goes a long way toward making the experience a rewarding one for a volunteer.**
11. Evaluate the volunteer encounter. Consider the specific request, the background of the volunteer and the constraints of the situation.

Appendix 13-2

Inviting a visiting scientist volunteer into your classroom

Every day, citizens are confronted with the need to understand complex technologies. The many members of the Colorado Alliance for Science would like to share with you, the teachers, the responsibility of providing scientific literacy to all our youth. Involving the community is one vital link in this process. And it is teachers like you who take that first important step.

Visiting Scientists volunteers can bring their first-hand experiences to the classroom to widen your students' horizons. Whether they are in your classroom for one lecture or throughout the teaching of a whole unit, these volunteers share their ideas and talents in an exciting way.

But before the event gets underway, we need your help. It is important to remember that resource people are usually not professional speakers. They are people donating time to you and your class to talk about careers and experiences, help coach a project or encourage an interest in science and math.

We ask you to take the time to go through this checklist and prepare for a most unique education experience. Then share your experience with other educators.

Checklist for teachers

- Plan ahead. Decide when a visitor might enrich your lesson plans and then call the Colorado Alliance for Science. The best programs result when there is plenty of lead time for planning (at least two weeks and as much as two months).

- Decide what kind of assistance you would like. Some teachers prefer a one-time presentation; others want a volunteer to work with a group of students on a regular basis; still others like to work one-on-one behind the scenes preparing a particular unit.

Talk with the volunteer

- If you don't hear from the volunteer, call the number listed in the notification letter you received from the Alliance. Teachers are often hard to reach, so help the volunteer by making the first call.
- Set your initial meeting as soon as possible.
- Provide directions to the school and to your classroom.
- Ask about his or her background.
- Prepare the volunteer for your students—their age, the size of your class, grade level, awareness level and attention span.
- Ask about special equipment needs such as a slide or overhead projector. Also find out if the volunteer has equipment to bring in which might enrich the experience.

- Discuss the format of the presentation. The two of you should decide together on the scope of the project and the format of your meeting(s).
- Discuss how such time will be involved. Work out the best time

for both the volunteer and your class.

- Provide your home phone number, so the volunteer can reach you in case of a sudden change of plans. Volunteers rarely cancel, but because they may be taking time out of a regular work day to come to your class, conflicts may arise.

Talk with the class

- Discuss with them why the speaker is coming.
- Have students prepare questions to ask the speaker.
- Prepare them with background information on the speaker and the topic.
- Discuss rules of courtesy.
- Notify your principal and school office to expect a visitor.
- Have the requested equipment available.
- Introduce the speaker to the class.
- Be present in the classroom. You are responsible for the class.

Finishing touches

- If necessary, ask questions or make comments to keep the discussion going. The volunteer will be relying on your teaching expertise.
- Consider taking pictures of the class and the volunteer working together for your bulletin board,

school newsletter and as souvenirs for the visitor.

Follow-up

- Consider writing a thank-you note to the scientist or ask the students to do so. Many volunteers proudly display such notes in their offices.
- Discuss return visits by the scientist.
- Ask if you might call upon the scientist with further questions and help in his or her area of expertise. You may want to keep the volunteer's phone number and address and invite that person back to your classroom.
- If appropriate, discuss with the scientist the possibility of a field trip to his or her place of employment.
- When appropriate, discuss the program with your colleagues who may also benefit by working with a volunteer.

Please don't hesitate to call the alliance at any time with additional questions.

Appendix 13-3

Tips for teachers

How Scientists Can Help You

Scientists, engineers and people who use science in daily life can:

- Demonstrate scientific concepts and direct applications of science and technology.
- Develop experiments and do them with students.
- Lead or arrange for field trips or guest speakers.
- Stimulate and guide independent research.
- Show students practical applications of computers in science.
- Serve as a resource person for you or your students.
- Help obtain, fix and maintain equipment.
- Serve as tutors, mentors and role models for individuals or small groups.
- Encourage female and minority students to enter science-oriented careers.

- Work with parents and families.
- Lead after-school science and math clubs.
- Assist with science, math and career festivals.
- And more—be creative!

A few days before the visit:

Call the volunteer to confirm your plans.

Prepare a welcome.

Select a team of several students to greet the volunteer and help with any equipment which may need to be carried in.

Prepare your students.

Explain who their guest is and what he will be doing. Review rules of courtesy. Prepare name tags so the scientist can call on students by name. If students will be working in groups, assign them ahead of time.

After the visit:

Extend appreciation.

Thank-you notes, drawings, or photographs from students are always appreciated. Scientists especially like to know what students learned and what interested them.

Follow up.

Discuss with your students what they learned and what else they want to know. Build on their experience with follow up activities. Incorporate interdisciplinary activities in writing, spelling, art, social studies, reading and math. Complete any experiments left by the visitor and let her know the results.

Share your experience with parents and colleagues as well as school administrators.

Plan for more visitors.

Make your experiences diverse. Invite people with different backgrounds, women and men, minorities and people with disabilities.

Appendix 13-4

We are all scientists

Children and scientists have much in common. Naturally inquisitive, young children ask endless questions. They may spend half an hour watching a bug crawl on the floor. Children sort money, pictures, toys, shells, pasta shapes and words. They experiment by pouring water into soil, mixing different colors of paints, or adding

blocks to a tower until it falls. They draw conclusions about the way things work. They learn from and share information with others.

Scientists share with children a natural curiosity about the world. They are trained to use a more systematic and sophisticated approach to inquiry than

children do. They have developed the discipline to remain objective, to reserve judgement until they have the facts and to recognize the limits of their knowledge. Nevertheless, the skills used in *doing* science are the same—whether you're a student or a scientist!

Science process skill	Children	Scientists
observe	look, touch, smell, taste, listen	microscope, x-rays, chromatography, seismograph
experiment	change something and watch what happens	change and control variables
collaborate	partners in classroom	colleagues around world
record	journal, score card	field notes, computer
measure	scale, ruler, stopwatch, measuring cup	computer analysis, calibrated apparatus
sort and classify	color, size, shape, weight	taxonomic key, relevant functional groupings
compare	fastest, largest, farthest	change over time, change in differing conditions
analyze	what happens most	statistical analysis
share information	class meeting at recess, "Guess what I found out?"	scientific meetings, E-mail; over coffee "Guess what I found out?"

Listed below are suggestions of people who might be able to help you in the classroom. Some are research scientists. Others use science in their

Appendix 13-5

Science in the classroom

everyday work life. Other people who might be helpful are hobbyists and collectors who study weather, plants, animals, astronomy, rocks and minerals, or fossils.

Animals

Zoologist, entomologist, microbiologist, marine biologist, paleontologist, cytologist, physiologist, chemist, ecologist, neurobiologist, geneticist, anatomist, mammalogist, limnologist, pharmacologist

Zookeeper, veterinarian, beekeeper, animal trainer, physician, forest ranger, wildlife manager, farmer, rancher, audiologist, nurse dietician, X-ray technician, forensic specialist, pharmacist

Plants

Botanist, paleobotanist, agronomist, agricultural chemist, ecologist, geneticist, paleontologist, pathologist, soil scientist

Horticulturist, farmer, forest manager, nutritionist, landscape architect, soil conservation officer, park ranger, agricultural extension agent

Weather

Meteorologist, ecologist, agronomist, geologist, oceanographer, climatologist

TV weather forecaster, airport flight controller, fisherman, boat captain, farmer, pilot, environmentalist, soil and water conservation agent

Physical and chemical properties

Chemist, biochemist, pharmacologist, molecular biologist, physicist, ecologist, toxicologist, metallurgist, geologist, forensic criminologist, materials scientist, engineers: chemical, textile, industrial, acoustical, optical, mechanical, civil, nuclear, agricultural and ceramic

Architect, inventor, mechanic, carpenter, musical instrument maker, musician, photographer, builder, police lab technician, water company technician, cosmetics developer, gemologist, building inspector, potter

Electricity and magnetism

Physicist, geologist, computer hardware/software designer, engineers: industrial, electrical, thermal, mechanical and electronic

Electrician, radar technician, amateur radio operator, telephone system maintenance technician, electrical inspector, inventor, radio\TV engineer

Earth and space science

Astronomer, geologist, paleontologist, ecologist, physicist, biologist, chemist, volcanologist, seismologist, oceanographer, soil scientist, engineers: aeronautical, aviation, construction and civil

Pilot, astronaut, geographer, cartographer, surveyor, geotechnical tester, aerial photographer

Behavioral and social science

Animal psychologist, clinical psychologist, psychiatrist, sociologist, anthropologist, historian, archaeologist, geographer, demographer

Marketing professional, business manager, city planner, applied economist, school psychologist, pollster, market research analyst, statistician

Appendix 14

Teacher request/ volunteer job description

I. Teacher Contact Information

name

date submitted

school

room number

school telephone

prep period

home telephone

II. Volunteer Job Description

Indicate the course name, students' grade and ability levels and how often you want the volunteer's services.

course name

students' grade levels(s)

number of students in each section

students' ability level(s)

date(s) for which the volunteer is requested

time(s)

Give a brief description of the topic and activities which you will be covering in class:

Objectives you would like to volunteer to cover:

Indicate the services and briefly describe the activities you are requesting from the volunteer (i.e., introductory presentation on the functions of the heart):

Return form to:

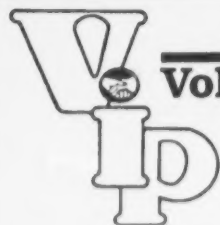
VIP Volunteers in Partnership

Month/Year

SHEET TOTALS

MONTH TOTALS

Appendix 15



Volunteers in Partnership

School Volunteer Project

in

Science, Mathematics and Technology Education

Certificate of Appreciation

Presented to

*In Sincere Recognition and Appreciation for
Your Support, Dedication and Service*

Jane Konrad, Executive Director
Pittsburgh Regional Center for
Science Teachers

Lauren Williams, Project Coordinator
Triangle Coalition for Science
and Technology Education

Appendix 17-1

Evaluation by the volunteer

Date of Volunteer Activity: _____

Name of Volunteer: _____

Employer: _____

Name of Teacher: _____

School: _____

Brief description of volunteer activity:

Circle the appropriate number of the following statements:

1. The teacher was helpful in planning the presentation:
agree 1 2 3 4 disagree
2. The teacher was prepared for the activity:
agree 1 2 3 4 disagree
3. The students were prepared for the presentation:
agree 1 2 3 4 disagree
4. The planned activity was appropriate for the volunteer:
agree 1 2 3 4 disagree
5. The teacher maintained an orderly setting for the presentation:
agree 1 2 3 4 disagree
6. The school welcome and arrangements (parking, etc.) were appropriate:
agree 1 2 3 4 disagree
7. I would volunteer in this situation again:
agree 1 2 3 4 disagree

Comments:

Return to:

Credit: Pittsburgh Regional Center for Science Teachers

Appendix 17-2

Evaluation by the teacher

Date of Volunteer Activity: _____

Name of Teacher: _____

School: _____

Name of Volunteer: _____

Brief description of volunteer activity:

Circle the appropriate number of the following statements:

1. The volunteer cooperated in planning the activity:

agree 1 2 3 4 disagree

2. The volunteer presented what was planned and adapted when necessary:

agree 1 2 3 4 disagree

3. The content and instruction were appropriate:

agree 1 2 3 4 disagree

4. The volunteer established and maintained rapport with students:

agree 1 2 3 4 disagree

5. The volunteer was prepared:

agree 1 2 3 4 disagree

6. The volunteer was punctual:

agree 1 2 3 4 disagree

7. I would request the services of this volunteer again:

agree 1 2 3 4 disagree

Comments:

Return to:

75

Be an open-minded scientist, not a magician

Unlike magicians, scientists attempt to find answers to what they do. Challenge the students to join in on the fun of finding these answers. Encourage them to think about why and how things happen. At the introductory level, it is far more important to provide non-threatening opportunities for the students to postulate "why?" than it is for their responses to be absolutely correct. If the accepted explanation is too complex to discuss, maybe the emphasis of the presentation is wrong. Reinforcing for students that a color change can be an indication of a chemical reaction may be more useful than a detailed explanation of the reaction mechanisms involved.

It is equally important to let the students know that not all the answers are known and that they too can make a difference. Teachers should be made to feel that saying "I don't know. What do you think?" or "Let's find out together," are acceptable responses.

It is also important to point out that not everyone's results will be the same. Reinforce the idea that a student's results are not wrong just because they are different from a classmate's results.

While using the term "chemistry," try relating the topics to real-life experiences. Science at the elementary school level is much less fragmented than it is for most chemists. Integrating topics into other non-science areas is also very useful. After all, chemistry is all around us, not just in the chemistry lab.

Take care to involve all students. It is very worthwhile to spend time talking informally with small groups or individual students before, during or after your presentation. It is important to leave the message that chemistry is for all who are willing to apply themselves to the questions before

Appendix 18

Chemists in the classroom

them. Chemistry is neither sexist, racist nor frightening.

Do some advance planning

What is pedagogically sound for college students, high school students, or even for yourself, may not be cognitively or behaviorally appropriate for prehigh school students. The expert on what is appropriate for children is the elementary or middle school classroom teacher. Prehigh school teachers may not be experts in chemistry, but they are experts on teaching children—so talk with the teacher as you plan your presentation.

As you and the teacher make your plans, you'll want to find out about:

- A. the grade and ability level of the students (gear your presentation specifically to their level). Remember that younger students may not have the fine-motor skills needed to fiddle with a number of test tubes or to assemble a complex apparatus. Students also vary greatly in their ability to interpret and follow a series of instructions.
- B. the previous science experiences the students have done, especially those relating to your area and what follow-up experiences the teacher is planning to engage the students in after your visit.
- C. the number of students with whom you will be interacting and what the room arrangement and facility is like. Remember many elementary classrooms are without running water and electrical outlets can be few. Also

remember to find out if the room is carpeted, if fire extinguishers are present, if goggles are available and if the room is properly ventilated for the activity you are planning.

- D. the materials and supplies that are already available for student use, the types of equipment they are used to manipulating and what sort of special equipment or supplies you should bring.
- E. the type of presentation that would be most suitable: small group demonstration, large group demonstration, hands-on/minds-on investigation, discussion groups, lecture role-playing or stimulation game, interactive computer program, school assembly program. Don't forget the size and amount of the material shared will need to be appropriate for the size of the class as well as the facility. Will you be positioned and have enough material so that everyone will be able to see and follow your actions?
- F. the length of presentation that is suitable for these particular students.

Take them from where they are and make them want to learn

Students learn by constructing new meaning from their past and present experiences. What they already know affects how they interpret any new events. Meaningful science instruction is presented as a series of concrete and relevant experiences that help to refine knowledge over time. Therefore, your presentation may be more effective if you keep the following ideas in mind:

- A. In doing experiments, hands-on activities or demonstrations, the instructor should not tell the students what to expect, but should instead allow the children

to express their own explanations of the observed events. The children, as learners, can then be challenged to see if their explanations fit with other new experiences or if they need to be changed.

- B. If you elect to discuss a little theory with students, be sure to emphasize the scientific explanations, e.g., that gas molecules "move farther apart" rather than "become larger"; a chemical change is a rearrangement of atoms.
- C. Teachers can guide students toward the acceptable explanations and help them modify their misconceptions and naive theories of the world. This approach has important ramifications for you as you give your presentation to a prehigh school science class. For example, young students can neither observe nor explain atoms and molecules. They can, however, observe a solid dissolve in a liquid and explain that it "disappeared but you can still see its color or taste its presence." At this point, the students can be challenged to explain how one cannot see the solid any more but can detect its presence in the liquid. The child can be led to a deeper understanding of chemical particles in this manner.

It is a good idea to take some instant photographs of students wearing goggles, performing a hands-on activity or observing your demonstration. Be sure to include the teacher and any adult helpers in the photos and ask another adult to include you in some photos. Teachers will be able to use these photos to publicize your visit and to sustain student enthusiasm generated by your visit, e.g., by designing displays for the classroom or for parents' night.

Become a resource for the teacher

If time and circumstances allow, offer to be a resource person for the teacher. Leaving your name for any future questions can be very useful to the teacher. If possible, share a list of follow-up activities, research topics or discussion points that the teacher might use to reinforce the concepts you have presented. Such materials expand the impact of your presentation beyond a one-shot performance and provide the teachers with resources to enrich their students' learning.

You may consider encouraging teachers to do additional demonstrations and provide materials and instructions for them to repeat your demonstration. By doing this, you not only reach more students, but allow the teacher to gain recognition. Ultimately, your approach should proliferate until you have essentially "worked yourself out of a job."

Make safety your first priority

Although the guidelines we have suggested above concentrate on the pedagogical issues of working with a prehigh school class, safety also must be considered at all aspects of your involvement. The following suggestions should be considered as you prepare and do your presentation. A more detailed discussion of the safety issues has been prepared by the American Chemical Society Safety Committee.

- A. Don't take short cuts on safety! Wear your goggles. Provide goggles for your volunteers, assistants and students who will come in contact with any chemicals. (Children's-sized goggles are available from many science suppliers.) Remember, as a visiting scientist you are a professional role model: the impression you leave with young children can influence them for a lifetime.

- B. Will there be ample adult supervision? (Parent volunteers can be added to assist you; ask the classroom teacher for advice.)
- C. Consider safety for the audience as well as the presenter. Think about: Will it bubble all over the table? Will it throw sparks? Will it leave a slippery residue on the floor?
- D. Specifically demonstrate proper technique, pointing out what you are doing, if appropriate. Demonstrate care and proper procedures when showing students concentrated acids and bases, volatile substances and toxic substances.
- E. Explosions and fires may be dramatic, but they may also be frightening. You must consider the impact on the students observing them—do you want to leave the message that chemistry is scary, noisy and dangerous? Elementary classrooms are not equipped to handle such demonstrations.
- F. Leave no waste behind! If you take it in, you carry it out! Prehigh school classes are not equipped for any type of disposal. Even such seemingly innocuous items as paper cups, popsicle sticks and zip-closing plastic bags containing the remains of an experiment can be very dangerous to the enthusiastic student who will innocently fish them out of the waste and play with the remains. A garbage bag is a handy thing to take with you.
- G. Take only what you need. Avoid taking a large reagent-size container into the classroom when you need only a few mL.
- H. Do not bring concentrated reagents if they are not needed. Carry out preliminary preparations that are not integral to the goal and success of the lesson prior to entering the classroom.

- I. Emphasize that all chemicals must be treated with respect. Remind students that this includes everything from sand to people.

Guidelines for the classroom teacher or science supervisor

1. When you invite a visiting scientist to your classroom, be as specific as possible about what you need. "Tell us all about chemistry" is not as helpful as "Help us study water." Consider the size of your group: a lab experience is unlikely to be practical for more than about 15 students. Be sensible in what you request.
2. Integrate chemistry lessons with other areas of the curriculum. There is a lot of chemical information that the students can absorb while studying history, geography, health and language. Take the time to develop a few special class projects that take advantage of this relatively cheap way to study chemistry.
3. Don't worry about not having all the answers for the students' questions about a chemistry topic. Understand the particular lesson involved (this is very important) but for questions about related areas, help the students find out the answers for all of you. It might be helpful to develop a bibliography of useful and readily available sources of information (both for yourself and for your students).
4. Emphasize the positive impact of chemical research and industry on your students' lives, not just the dangers. We risk turning off our students to the value of the sciences in our lives because we

focus too much on the problems generated by our use of resources. All of the matter in the biosphere is, of course, "chemical," including the students' bodies, food, etc. It is an important goal that all people understand and respect natural phenomena since all people are directly affected by chemical processes.

5. Try to involve parent volunteers in your outside activities. Especially when trying hands-on activities, you can't be every-

For further information

Excellent hands-on activities can be gleaned from popular science books for children or from materials especially designed for teachers of prehigh school classes. You may also wish to read more about the following:

- I. Cognitive and Behavioral Psychology
Learning to Learn by Joe Novak
Circles of Learning by Johnson and Johnson
Piaget for Educators by Sund and Bybee
The Piaget Primer by Labinowicz
- II. Ideas for the Classroom
Science and Children, the journal published by the National Science Teachers Association
"Chemistry for Kids" in the *Journal of Chemical Education*
WonderScience by the American Chemical Society's Prehigh School Office.

where at once, nor can you answer the same question thirty times.

6. Be sure you understand any safety precautions required for chemicals used in the experiments and model the correct safety procedure. It's too late to look things up after someone has spilled a solution. Since you would require your students to wear safety goggles to do an experiment, wear them yourself when doing a demonstration.